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MONROE'S STANDARDIZED SILENT READING TESTS*

WALTER S. MONROE

Director of Bureau of Educational Measurements, Kansas State Normal School, Emporia, Kansas

The widespread use of the Kansas Silent Reading Tests, devised† by F. J. Kelly is evidence that school men generally feel the need for a simple instrument for measuring the ability of pupils to read. These tests were made available for general distribution in September, 1915, and within a year there was a demand for a duplicate form of the tests or similar tests because in those cities where the tests had been given the pupils were acquainted with the exercises. It was to meet this demand that the derivation of the tests described in this article was undertaken. The author has attempted to introduce certain improvements which will be mentioned below, but he is very conscious of his indebtedness to the originator of the plan upon which the Kansas Silent Reading Tests are based.

The first step in the derivation of reading tests of this type is to secure suitable exercises. The thesis of the writer is that ability to understand sentences and paragraphs depends in part upon one's store of information. Hence, in order to read with understanding in a special field such as arithmetic or geography, it is necessary that one have an acquaintance with this field. In selecting exercises an attempt has been made to restrict them to what we may call the field of general reading and not to include any taken from a particular field, such as arithmetic or geography. Accordingly

*Sample copies of these tests may be obtained by addressing the Bureau of Educational Measurements, Emporia, Kansas. The tests are sold in any quantity desired for fifty cents per one hundred copies.

†An account of the derivation of these tests was published in the Journal of Educational Psychology, February, 1916. See this reference for details of the method used in the derivation of the tests described in this article.

school readers and other books which children read were examined for paragraphs which might be used as a basis for such exercises. To illustrate, in one of the school readers examined this stanza was found,

"O suns and skies and clouds of June,
And flowers of June together,
You can not rival for one hour
October's bright blue weather."

Upon this stanza the following question was used. "Which month does this stanza say is the more pleasant?"

It is realized that in the reading of such a stanza one's purpose may not be to secure information; it may be to enjoy the phrasing and rhythm of the poem, but in so far as one's purpose is intellectual, one should get from the stanza the idea which is called for in the question. There may be other ideas which one should get from this stanza but it seems clear that this is the dominant one.

By examining school readers and other books and by means of the assistance of a class in Educational Measurements, about three hundred exercises were secured. Out of this number 157 were selected to be evaluated. Out of this selected list as will appear later, another selection was made for those which compose the tests.

It is perhaps worthy of note that the greatest difficulty encountered in securing exercises was in finding ones suitable for the lower grades. It was with great difficulty that a sufficient number was secured and the writer believes that they are inferior in quality to those for the upper grades.

The plan* of evaluation used was to have the exercises given to pupils in such a way that the time required and the accuracy of the answers could be noted. For this purpose the exercises were printed on slips of paper with the lines of print approximately the same length as those to which the pupils are accustomed. Ten-point type was used. This perhaps is smaller than the children in the third grade are accustomed to but this criticism does not apply to the grades above the third.

The slips of paper upon which an exercise was printed were stapled together in bundles of five and each labeled with the grade in which the bundle was to be given. The plan of giving the exercises was

*The directions, blanks and several of the details of the plan are not given here. The author will be glad to supply them upon request, or they may be found in the article describing the derivation of the Kansas Silent Reading Tests.

to have the pupils seated so that there were at least five pupils in a row. The pupil in the front seat was given a bundle and began to read it at a signal from the teacher. As soon as he had finished the exercise, he tore off his sheet and passed the remaining papers to the pupil behind him. This process was repeated until the fifth pupil had finished. The total number of seconds and the number of errors were recorded. In determining the grades in which the exercises should be given the assistance of the supervisors of the Normal Training School and of a class of students in Educational Measurements was secured. The exercises were placed in accordance with the concensus of the judgment of these people. It was planned to have each exercise given to three hundred pupils, seventy-five pupils in each of four consecutive grades. Because of the many things which occurred in the fall of 1917 to disturb school work some of those who planned to co-operate in the work found it impossible to give the exercises and consequently this ideal was not attained in many cases.* In a few cases the record reported for certain exercises was practically impossible. Such records were not used in any of the tabulations. However, after excluding these cases the average number of pupils doing each exercise was 186.

For each exercise there were secured and tabulated on a card by grades, the number of pupils to whom the exercise was given, the total number of seconds required and the number of errors made. From these data the average number of seconds required to obtain a correct answer was calculated for each grade. This number re-

*The writer is indebted to the following persons for securing the data upon which the tests are based by giving the exercises in their schools: Supt. D. C. Bliss, Montclair, N. J.; Supt. J. F. Bender, Pittsburg, Kansas.; Supt. W. S. Heusner, Salina, Kans.; Supt. W. A. Walls, Martins Ferry, Ohio; Supt. Earnest C. Witham, Southington, Conn.; Supt. Chas. A. Wagner, Junction City, Kans.; Supt. A. S. Anderson, La Grange, Ill.; Supt. E. B. Gift, Manhattan, Kans.; Supt. A. S. Lyness, Norton, Kans.; Supt. L. W. Fulton, Ellsworth, Wisconsin; Supt. C. A. Yeomans, Minneapolis, Kans.; Supt. J. O. Hall, Hutchinson, Kans.; Supt. H. H. Van Fleet, Aspen, Colo.; Supt. David Gibbs, Meriden, Conn.; Supt. R. E. McCormick, La Crosse, Wisc.; Supt. A. C. Kingsford, Baraboo, Wisc.; Mr. I. J. Bright, Topeka, Kans.; Supt. M. E. Pearson, Kansas City, Kansas; Supt. S. H. Holmes, New Britian, Conn.; Prin. A. S. Philips, Denver, Colo.; Asst. Supt. J. W. Studebaker, Des Moines, Ia.; Supt. F. H. Prout, Chillicothe, Ohio; Supt. F. W. Travell, Ridgewood, N. J.; Supt. P. S. Berg, Dickinson, N. Dak.; Mrs. Mary A. Davis, Claremore, Okla.; Mr. George Melcher, Kansas City, Mo.; Supt. Frederick B. Knight, Danvers, Mass.; Supt. E. C. Fisher, Rock Island, Ill.; and Mr. W. S. Dakin, Hartford, Conn.

presents the "difficulty" of the exercise. The "weighted difficulty" was obtained by the method described in the following paragraphs.*

Since the exercises were given in the successive grades it was possible to compare the reading ability of fourth grade pupils with that of third grade pupils when working on the same exercises. In Table I there is given for the several grades by pairs the number of pupils who took the same exercises, the total number of seconds required for these pupils to do the exercises, the number of errors made by the pupils and the average number of seconds per correct answer. This last item is obtained by subtracting the number of errors from the number of pupils and using this remainder for the divisor into the total number of seconds. Third grade pupils required on the average 143 seconds for each correct answer. When doing the same exercises it required only an average of 74 seconds for fourth grade pupils to secure a correct answer. The quotient of the reciprocals of these two numbers (74:143) represents the ratio of the silent reading ability of third grade pupils to silent reading ability of fourth grade pupils.

From the facts of Table I it is possible to calculate ratio of the silent reading ability for any grade to the silent reading ability of the third grade. These ratios are given in Table II. They are the factors by which the average number of seconds required for pupils of any grade to do an exercise correctly (or the "difficulty" of an exercise) must be multiplied to reduce the difficulty to the basis of third-grade silent reading ability. This product (the average number of seconds required to secure a correct answer times the ratio for that grade) is called the "weighted difficulty."

In calculating the average difficulty of an exercise it was thought wise not to use the "weighted difficulty" of a grade in which the exercise was not to be used in the test. For example, if an exercise had been given originally in grades 3, 4, 5, and 6 and it was to be used only in grades 3, 4, and 5 the "weighted difficulty" for the sixth grade was not used in determining the average difficulty.

From the average difficulty the comprehension score has been calculated by simply dividing the average difficulty by 81. The

*Tables were prepared showing the number of pupils in each grade reading each exercise, the total number of pupils reading each exercise, the weighted difficulty for each grade, the average difficulty, comprehension score, and the place to which the exercise was assigned. Owing to limitations of space these tables cannot be reproduced here.

choice of 81 as a divisor has no significance. It was chosen because it happened that this was the lowest average difficulty of a number of exercises which were used in a preliminary tabulation.

In choosing exercises for the tests an effort was made to reject (1) all exercises considered unsatisfactory by those who co-operated in giving exercises and (2) those exercises for which the weighted difficulties in the successive grades were not approximately equal. In every case an exercise was excluded if commented upon adversely by those co-operating. It was not possible to reject in every case those exercises whose statistical behavior was not wholly satisfactory but it is believed that no exercise was included which is open to serious criticism on this basis.

In a report on the use of Kansas Silent Reading Tests* the writer has shown that a score on these tests measures the comprehension rather than the rate of reading. The method used for determining the comprehension value described above is essentially the same as that used by Kelly in the case of the Kansas Silent Reading Tests. For this reason it has seemed wise to give each exercise a rate score. The rate score has been determined by counting the number of words in an exercise and dividing the total by five. Five was used as a divisor because five minutes are allowed for giving the tests and thus the pupils' rate score will be the number of words read per minute. It should be noted, however, that since the material read is not uniform in difficulty this rate score can have only a very general meaning.

The number of exercises was sufficient to make it possible to construct three forms of Test I and Test II and two forms of Test III. In Table III the comprehension values of the exercises which compose the different forms of these tests are given. It was not possible to choose exercises for duplicate forms with exactly equal values. Just how much the slight differences will affect the scores can be determined only by actual trial. At the time when this report was written this had not been done. It should be remembered that considerations other than the comprehension values entered into the choice of exercises for the several forms of the tests. It was necessary to give consideration to the length of the exercises, because the tests were printed on a four page folder of fixed size. This is the reason why the number of exercises for the different

*WALTER S. MONROE. *Report on the Kansas Silent Reading Tests With Over One Hundred Thousand Children.* Journal of Educational Psychology, December, 1917.

forms of Test I is not the same. Attention was also given to the general character of the exercises. Test II, Form I is reproduced to illustrate the nature of the series of tests.

In Table IV median scores are given which may be used as tentative standards. The median scores for grades 9 to 12 are based on returns from only a few cities and in addition the number of pupils in each grade is very small. Thus the medians for these grades are probably not reliable standards. However, the medians for grades 3 to 8 are based upon a sufficient number of cases so that it is very probable that additional data would make few changes. The tests on which these medians (3 to 8) are based were given between April first and the close of the school year. Hence they may be considered as end of the year standards.

It should be noted that the decrease in the rate of reading from the fifth to the sixth grade and from the eighth to the ninth is to be expected because at these points different tests are used. The exercises of the tests are more difficult and require more time for reading.

The comprehension medians approximate the learning curve except from the fifth to the sixth grade and from the eighth to the ninth grade. The drop from the eighth to the ninth might be explained by the relatively small number of cases in the high school grades, but the same explanation will not apply to the other case. It appears, therefore, that although an effort was made to have the exercises of the several tests evaluated in terms of a common unit, the units in Test II are larger than those in Test I and those in Test III are larger than those in Test II. The ratio of these units must be determined in order that progress may be judged at the points where the tests are changed.

In comparison with the Kansas Silent Reading Tests it is believed that these tests possess the following points of superiority.

1. The exercises are more uniform in character. They are confined to what we may call the field of general reading.

2. The exercises have been more reliably evaluated. Kelly had the exercises given to only 60 pupils. The exercises of these tests were given on the average to 186 pupils. In the second place, the exercises were printed and not mimeographed. It should also be noted that the pupils to whom the exercises were given were not confined to any particular state or section of the country.

3. The comprehension values of the exercises are more uniform. They range only from 1 to 10.1 with one exception and the value of that exercise is 18.5.

4. Duplicate forms of the tests consisting of exercises with approximately equivalent values have been provided.

STANDARDIZED SILENT READING TEST, TEST II, FORM 1

For Grades 6, 7 and 8

No. 1

Rate Value 5 Comprehension Value 2.1

Oil floats on water because it is lighter than water. Milk mixes with water because milk and water are of equal weight.

Which is lighter, oil or milk?.....

No. 2

Rate Value 7 Comprehension Value 2.1

At evening when I go to bed
I see the stars shine overhead;
They are the little daisies white
That dot the meadow of the night.

What are the little white daisies of the night?

.....

No. 3

Rate Value 12 Comprehension Value 2.7

The dog lay down. The rooster flew to the top of a tree and the cat climbed to one of the branches. Before they went to sleep the rooster saw a light in the forest. He called to his friends.

Where was the light the rooster saw? Draw a line around the word that tells where.

sky house barn wagon forest

No. 4

Rate Value 7 Comprehension Value 2.8

O sun and skies and clouds of June,
And flowers of June together,
You can not rival for one hour
October's bright blue weather.

Which month does this stanza say is the more pleasant? .....

No. 5

Rate Value 8 Comprehension Value 3.1

They rested and talked. Their talk was all about their flocks, a dull theme to the world, yet a theme which was all the world to them.

What do you suppose was the occupation of these men?

carpenter doctor merchant shepherd blacksmith

No. 6

Rate Value 4 Comprehension Value 3.3

Africa is smaller than Asia, and North America is not as large as Africa. Which is smaller, Asia or North America? .....

No. 7

Rate Value 11 Comprehension Value 3.2

. The fly does not care whether it is king or clown whom he teases. He has no work to do—no instinct to obey. The earthworm has his digging; the bee her gathering and building; the spider her cunning network; the ant her treasury. They are slaves.

Is the fly a free creature or a slave? .....

No. 8

Rate Value 15 Comprehension Value 3.7

He said to his friend: "If the British march
By land or sea from the town tonight,
Hang a lantern aloft in the belfry-arch
Of the North Church tower, as a signal light,
One if by land and two if by sea;
And I on the opposite shore will be
Ready to ride and spread the alarm."

If the British came by land, how many lights did the man see in the church tower?

.....

No. 9

Rate Value 16 Comprehension Value 3.8

It was cold, bleak, biting weather; foggy withal; and he could hear the people in the court outside go wheezing up and down, beating their hands upon their breasts and stamping their feet upon the pavement-stones to warm them.

The author has attempted to give you a picture in this paragraph. After reading the paragraph, if you think it is a picture of comfort and pleasantness, underline the word hear; if of cheerlessness and dreariness, underline bleak.

hear wind bleak cold

No. 10

Rate Value 13 Comprehension Value 4.1

It is a beautiful moonlight night. Mary and Kate are invited to a party. Kate promised to come by for Mary. Mary has hurried to get ready and is impatiently waiting for Kate. When it was too late to go, Kate's mother telephoned that Kate could not go.

Underline the word below that most nearly describes how Mary now felt.

happy comfortable sad excited

No. 11

Rate Value 10 Comprehension Value 4.4

The boy stood on the burning deck,
Whence all but he had fled;
The flame that lit the battle's wreck,
Shone round him o'er the dead:
Yet beautiful and bright he stood,
As born to rule the storm.

Underline the word that best describes the boy.

cowardly mischievous brave young good

No. 12

Rate Value 11 Comprehension Value 4.9

Aladdin's uncle said: "I will take a shop and furnish it for you." Aladdin was delighted with the idea, for he thought there was very little work in keeping a shop. He liked that better than anything else.

Underline the word below that tells us what kind of a boy Aladdin was.

industrious ambitious active lazy honest

No. 13

Rate Value 14 Comprehension Value 5.2

Not far from Greensburg is a little valley, among the high hills. A small brook glides through it, with just murmur enough to lull one to repose; and the occasional whistle of a quail, or tapping of a woodpecker, is almost the only sound that ever breaks in upon the uniform tranquillity.

What kind of a picture do you get from reading the above paragraph?

disorder activity noise calmness confusion

No. 14

Rate Value 13 Comprehension Value 5.4

The soldier crawled out of the trench, where he had spent the night. He was covered with mud from head to foot, and almost frozen. He looked around at his companions. What a miserable lot they were! This, then, was the glorious war told about in the papers.

Underline the word below that tells how the soldier felt.

happy patriotic brave angry downhearted

TABLE I

Showing Relative Ability of Pupils in Successive Grades Doing Same Exercise

Grade	III	IV	IV	V	V	VI	VI	VII
Number of Pupils	1,801	1,793	2,449	2,421	3,526	3,533	3,774	3,839
Total Seconds	146,962	95,078	138,514	87,751	157,620	136,143	155,237	160,859
Errors	772	511	845	588	1,193	1,145	1,327	1,028
Ave. No. Sec. per Correct Answer	143	74	86	48	68	57	63.5	57

TABLE I—*Concluded*

VII	VIII	VIII	IX	IX	X	X	XI	XI	XII
2,407	2,378	1,283	1,302	1,302	1,317	1,253	1,253	1,008	1,070
101,761	89,973	55,981	51,723	61,086	62,657	58,511	53,875	45,545	42,460
618	552	393	372	520	476	451	387	339	317
57	49	63	56	78	75	73	63	68	56

TABLE II

Ratio of Silent Reading Ability of Pupils in the Several Grades

Grade....	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Ratio....	1.00	1.92	3.44	4.16	4.65	5.40	6.06	6.29	7.10	8.85

TABLE III

Showing Comprehension Values of the Exercises of the Different Forms

Ex. No.	Test I Form I	Test I Form II	Test I Form III	Test II Form I	Test II Form II	Test II Form III	Test III Form I	Test III Form II
1.	1.3	1.1	1.0	2.0	2.0	2.2	2.8	3.5
2.	1.3	1.1	1.2	2.1	2.8	2.3	3.5	3.6
3.	1.3	1.3	1.3	2.7	2.7	2.6	4.8	4.0
4.	1.4	1.4	1.4	2.8	2.8	2.7	4.9	4.4
5.	1.4	1.4	1.5	2.8	3.2	3.3	5.0	4.8
6.	1.5	1.5	1.5	3.0	3.3	3.2	5.6	5.4
7.	1.7	1.7	1.7	3.0	3.7	3.7	5.6	5.7
8.	1.8	1.8	1.8	3.4	3.7	3.8	5.9	5.8
9.	2.0	2.3	2.0	3.4	3.8	3.9	6.6	7.6
10.	2.3	2.1	2.3	3.6	4.0	4.0	6.7	8.9
11.	2.5	2.4	2.3	4.1	4.1	4.6	7.7	9.2
12.	2.7	2.5	2.4	4.3	4.6	4.7	18.5	10.1
13.	2.9	2.6	2.9	4.4	4.7	5.2		
14.	2.9	2.8	3.0					
15.	3.0	3.0						
16.	3.5							

TABLE IV

Standards—Median Scores

Grade	III	IV	V	VI	VII	VIII	IX	X	XI	XII
No. of Pupils	5402	5519	5221	4734	3752	2998	349	355	282	162
Rate	57	83	91	96	98	108	87	81	88	89
Comprehension	8.7	15	20	21	25	28	22	25	26.4	27

PSYCHOLOGICAL ASPECTS OF LANGUAGE

GEORGE C. BRANDENBURG
Purdue University, Lafayette, Ind.

PURPOSE AND METHOD

Purpose. The investigation discussed in this article was undertaken for the purpose of contributing some data upon the question of the relation of language to general intelligence. It is hoped that the material presented may aid in a small degree in answering the following questions: What is the relation between the extent of a pupil's vocabulary and his scholastic attainments? What correlation exists between accuracy and precision in the knowledge and use of words, and vocabulary range? What are the chief factors in the acquisition and use of words? To what extent does present-day school room practice facilitate the pupil's linguistic development?

Method. From a series of preliminary investigations it was decided that the following principles were valid for a vocabulary test: (1) The best test as to whether a word is sufficiently well known by a pupil to be credited to him is his ability to use it correctly in a sentence. (2) The range of vocabulary varies so much within any group that a pupil must be tested upon approximately the entire list of words used, and this list must range from the most simple to the most difficult. (3) The list of test words should be short enough to be completed by the average pupil at one sitting of thirty or forty minutes. Accordingly the final test was arranged containing 200 words, one for every 140 in Webster's Academic Dictionary. The words were selected at equal intervals throughout the dictionary. The test was printed in the form of a four page folder, the words being arranged as nearly as possible in order of difficulty, and each pupil was furnished with a copy. The test was given to 2000 pupils of 68 different classes from the second to the twelfth grades, in 16 schools of six different school systems located in Wisconsin, Iowa, Missouri and Colorado. The places in which the tests were given vary in size and character from an agricultural town of 1200 people to a small modern city of 30,000. The author supervised personally the giving of 800 of the tests; the remainder were given under the direction of the various principals of these schools. The tests were all given during the month of May so that the results show the rankings and averages of the various

grades at the end of the school year. The instructions to the pupils which were placed at the top of the first page of the folder were as follows: "In the blank space after each word that you know, write a sentence using the word correctly. Place a cross before each word that you do not know. For seventh grade pupils and above omit the first 25 words." On the last page of the folder were spaces for the pupils' grades in English, manual training, oral expression and average scholarship, with a request that these grades be supplied by the teacher.

With respect to scoring results any such test is, to a certain extent, defective, since it is not always possible to decide from a pupil's use of a word in a sentence whether he knows the word or not. The principle which was followed in grading the papers was that the attempted use of a word is an indication in itself that the word is known, and unless the use in the sentence was such as to indicate that it was not known, the pupil was given credit for it.

Grade Averages and Variations in Vocabulary

In a study somewhat similar to the present one Kirkpatrick (7) attempted to find the average size of the vocabulary for each grade, and, while the method used was different, the results did not differ materially from those found here. His averages were as follows: Grade II, 4480; Grade III, 6620; Grade IV, 7020; Grade V, 7860; Grade VI, 8700; Grade VII, 10660; Grade VIII, 12000. Comparing these results with those in Table I, it will be seen that the increase in size of vocabulary from year to year appears much more uniform here than Kirkpatrick found it to be. The averages for Grades II and III and for those above the eighth in Table I cannot be regarded as reliable on account of the small number of pupils tested. It will be noted that the average of the three tenth grades tested is larger than either the eleventh or twelfth grade average. No explanation of this can be offered except that in the case of two of the tenth grades the principals remarked that they were unusually strong classes. The average gain from year to year for Grades II to VIII is approximately 1400 words. It appears that the gain in the seventh grade is greater than that for any other year, being 371 above the average. This is seen to be the case also in Kirkpatrick's results, disregarding Grades II and III which are admittedly unreliable. It was found by Dr. Jones, in a study of pupils' compositions that the greatest gain in the number of words

used by pupils of one grade over those of the preceding grade was in the seventh grade. It is quite likely that this unusual increase in linguistic ability in this grade is due to the fact that a large number of dull pupils drop out of school at the end of the sixth year. This

TABLE I

Average Size of Vocabulary for the Various Grades as Determined by All the Tests Which Were Completed

Grade	No. of classes	No. of pupils	Av. vocab-ulary	Gain over pre-ceding year	A. D. of classes	Per cent deviation
II	1	22	4000			
III	3	78	5429	1429	453	6.5
IV	8	228	6887	1458	453	6.5
V	10	245	8207	1320	717	8.7
VI	13	378	9613	1406	754	7.8
VII	11	300	11445	1832	581	5.0
VIII	10	255	12819	1374	779	6.0
IX	3	72	13504	685		
X	3	71	15340	1736		
XI	3	71	13974			
XII	3	41	14975			

A. D., average deviation.

would seem to explain the fact that there is a smaller percentage of variation among seventh grades than among the classes of any other grade. Some rather surprising facts are discovered when we compare the grades of different schools: The highest fourth grade had an average vocabulary of 8806, being larger than the average of the fifth grades and almost as large as the average of the sixth. The best eighth grade with a vocabulary of 14218 apparently had a better knowledge and command of words than the poorest senior high school class, and almost as good as the average of the three senior classes. These cases are typical of the overlapping in vocabulary ability throughout. In a later section dealing with the causes of individual variation in vocabulary an attempt will be made to explain these variations in grade averages, since whatever factors operate to cause individual differences would also tend to cause differences between grades.

Averages for Boys and Girls

The differences between boys and girls in the matter of vocabulary do not appear to be great as will be seen from the following table, and not uniformly in favor of either.

TABLE II

Grade	Boys	Average	Girls	Average
III	38	5527	40	5372
IV	126	6546	102	7308
V	114	8165	131	8320
VI	210	9886	168	9327
VII	146	11363	154	11472
VIII	113	12914	142	12627
IX	38	13357	34	13659
X	45	15112	26	15738
XI	41	14294	30	13352
XII	21	15634	20	14273
Average	892	10232	847	10156

The girls average 76 words less than the boys, an entirely insignificant difference. The boys rank higher in five grades, while the girls are higher in the other five.

The Relation of School Abilities to Range of Vocabulary

The grades of approximately 1500 pupils were returned on the test sheets sent to teachers, about 500 papers being returned without the grades. For about 200 pupils the grades in average scholarship and language were given in figures, the remainder being in letters or words. It was not expected that the grades in oral expression would be very reliable since teachers, generally, pay little attention to grading this ability. It was thought, however, that the estimates thus secured would aid in discussing the proposition that there are many persons who have large vocabularies and are still unable to give clear expression to their thoughts.

Language Grades and Vocabulary Ability. Table III contains a summary of the results of the test in the classes in which the language grades were returned in figures. The vocabulary index is the number of words correctly used from the 200 word list. The coefficient of correlation is represented by r, and was calculated by the Pearson formula. The average deviation is indicated by A. D.

TABLE III

			Vocabulary Indices				Language Grades				
School	Grade	No. pupils	Av.	Highest	Lowest	A. D.	Av.	Highest	Lowest	A. D.	r.
X	IV	26	48	65	26	6.1	83.8	91	72	4.0	.73
II	V	17	60.7	77	46	6.6	80.3	91	70	5.2	.90
IX	VI	35	72	89	43	9.7	83.7	95	70	6.6	.54
X	VI	20	59.2	70	43.6	6.8	79.5	88	67	5.5	.85
VI	VII	40	80.5	109	48	7.8	80.5	95	60	4.9	.82
XI	VII	18	84	106	66	7.7	85	95	70	6.6	.66
I	VIII	26	84	114	63	12.8	83.4	91.5	72	3.6	.72
XV	X	21	110.5	128	82	11.7	86.5	95	70	5.6	.81

In this table two features stand out prominently: (1) The marked deviations from the average in vocabulary ability and the absence of such deviations in the language grades; (2) the high degree of correlation between the two abilities considered. The latter is of considerable significance to the teacher since it indicates that she could by a vocabulary test estimate the language ability of her pupils in an objective and impersonal manner, accurately and easily. The fact that all the pupils of a certain group, as for example, Grade VIII, School I, are using the same text book, doing the same outside reading, are expected to write the same sort of compositions, in short, are subject to the same linguistic requirements, when certain individuals in the group understand and are capable of using almost twice as many different words as are certain others, points strongly toward the conclusion that there is something fundamentally inadequate in the basis for the grouping.

It is somewhat surprising, considering the various factors tending to produce abnormal results, which are usually present in giving such a test, that the degree of correlation should be so high. The lowest coefficient is .54, the highest .90, while the average of the eight coefficients is .76.

Table IV shows the relation between the vocabulary abilities and the language grades of 1000 pupils whose grades were given in letters or words.

TABLE IV

Language grade	No. pupils	*Distribution on Basis of Vocabulary Ability*							
		Excellent		Good		Fair		Poor	
		No.	%	No.	%	No.	%	No	%
Excellent	146	86	59	56	38.3	4	2.7	0	0
Good	459	55	12	295	64.3	94	20.5	15	3.2
Fair	291	5	1.7	100	34.4	144	49.4	42	14.4
Poor	104	0	0	6	5.8	43	41.3	55	52.8

In order to make clear the method by which these correlations were worked out let us consider a group in which the teacher had marked 5 pupils E; 22, G; 8, F and 1, P. Assuming this apportionment for the group, we then divided the class as to vocabulary scores in the same proportions. We then find that three of the E pupils in language fall within the E division in vocabulary, and two in the G group; that 16 of the G pupils in language fall within the G group in vocabulary, two in the E group, and four in the F group; that three of the F pupils in language fall within the F group in

vocabulary, four in the G, and one in the P group; that the one P pupil falls in the F group in vocabulary. The scores of the 1000 pupils were distributed relatively to the grades in this manner.

The fact that the correlation is higher in the "Excellent" and "Good" divisions probably indicates that teachers grade more accurately here than in the "Fair" and "Poor" groups. That is, they probably tend to raise the grades of fair or poor pupils above what they should be.

Oral Expression and Range of Vocabulary. When the grades in oral expression are compared with vocabulary abilities we find about the same relationship as existed between language grades and vocabulary ability. The average tendency of grades in oral expression

TABLE V

Oral Expression grades	No. pupils	*Distribution on Basis of Vocabulary Ability*							
		Excellent		Good		Fair		Poor	
		No.	%	No.	%	No.	%	No.	%
Excellent	180	110	61.1	58	32.2	12	6.7	0	0
Good	418	62	14.8	283	67.7	62	14.8	11	2.6
Fair	260	7	2.7	75	28.9	128	49.2	50	19.2
Poor	142	0	0	7	4.9	52	36.7	83	58.4

to fall within their proper or corresponding groups in vocabulary ability is seen to be slightly above 59%. It will be noted that no pupil who was excellent in vocabulary was poor in oral expression and that no pupil who was poor in vocabulary was graded excellent in oral expression. Here again we have evidence of the better grading by teachers in the "Excellent" and "Good" groups. From the material presented here we are forced to the conclusion that there are relatively few persons who have large vocabularies and are not good in oral expression. The fact that about 5% of the pupils who were marked poor in oral expression are in the good division in vocabulary indicates that there probably are such individuals.

Range of Vocabulary and Average Scholarship. The average scholarship grades, in most cases, represent the teachers' estimates of the quality and quantity of pupils' achievements in all their studies except manual training. These grades were given in figures for only five classes. It will be noted that the coefficients of correlation vary from .39 to .85, the average of the five being .63.

TABLE VI

			Vocabulary Indices			Average Scholarship Grades					
School	Grade	No. pupils	Av.	Highest	Lowest	A. D.	Av.	Highest	Lowest	A. D.	r.
X	IV	26	48.2	65	26	6.1	81.5	91	75	4.1	.85
IX	VI	35	72	89	43	9.7	80	90	65	6.9	.60
XI	VII	18	84	106	66	6.6	84.7	95	70	5.9	.64
VII	VII	20	84.4	118	65	16.3	79	84	74	1.9	.39
XV	X	21	110.5	128	82	11.7	87	94	80	4.3	.70

TABLE VII

Average Scholarship Grade	No. of pupils	Distribution on Basis of Vocabulary Ability: Excellent No.	%	Good No.	%	Fair No.	%	Poor No.	%
Excellent	163	93	57	65	39.8	5	3.1	0	0
Good	427	60	14	270	63.2	82	19.2	15	3.5
Fair	277	10	3.6	82	29.6	140	50.6	45	16.1
Poor	133	0	0	12	9.	48	3.6	73	55.

It would seem from Table VII that there is as high a correlation between average scholarship and size of vocabulary as there is between oral expeession and vocabulary ability. The average per cent. of exact correspondence in groups is approximately the same in both cases, a little above 56 per cent.

In view of the above results we may safely say that the opinion sometimes ventured, that there are certain individuals who have a large fund of words at their command and are very proficient in the use of words generally but are mentally weak and inefficient, is by no means well founded. The only other alternative is that average scholarship grades are not indcative of mental capacity; it would be difficult, indeed, to defend such a proposition.

Manual Training Grades and Range of Vocabulary. The theory that motor ability and verbal capacity do not tend strongly to coincide is supported by the following table.

TABLE VIII

Manual Training Grade	No. pupils	*Distribution on Basis of Vocabulary Ability*: Excellent No.	%	Good No.	%	Fair No.	%	Poor No.	%
Excellent	66	23	34.8	35	53	8	12.1	0	0
Good	248	39	15.7	179	72.2	20	8.	10	4.
Fair	70	4	5.7	31	44.3	32	45.7	3	4.2
Poor	36	0	0	6	16.7	15	41.6	15	41.6

It will be noted that more of the E pupils in manual training come in the G rank in vocabulary than come in the E rank; that about as large a percentage of the F pupils in manual training come in the G rank in vocabulary as come in the F rank; while just as many of the P pupils in manual training come in the F

group in vocabulary as come in the P group. It is significant, however, that no E pupil in manual training is found in the P group in vocabulary.

As a check upon these results a personal study was made of a group of 48 high school pupils. After securing the instructor's grades upon these pupils in manual training, they were given the vocabulary test, and the correlation between the two abilities was found to be .21. It was found by inspection of the details that the pupil who ranked highest in vocabulary was marked 2% below the average in manual training, and that the pupil who ranked lowest in vocabulary was graded 5% above the average of his class in manual training. On the other hand, all the pupils who had marks as low as 60% in manual training were found in the lower half of the group in vocabulary ability.

Difficulties and Errors in the Use of Words

The list of test words is here given arranged in order of their relative difficulty upon the basis of results of the test.

	Orange		heart		seek		direct		charity
	cup		hour		balance		favor		reclaim
	penny		worse		beetle		shaft		unfortunately
	light		stump		kernel	49	psalm		crinkly
	frog		grain		skeleton		text		insure
	storm		report		*		revolution		landman
	week		roast		failing		gill		lonesomeness
	twenty		important		somerset		partition		ferry
	flat		shiny	39	childhood		ye	69	bower
	third		remain		rate		hippopotamus		lubber
	place		foamy		labor		betrayer		bred
	square		absent		diving		triangle		inclined
	be		barehead		sup		morsel		everlastingly
	east	29	camera		content	59	foremost		vail
	frame		snuff		gaily		crackle		numbness
82	downcast		polygamist		potent		circularity		anastrophe
	observation		picklock		interposer		de capo		epicarp
	inkhorn		grievance		municipality		saline		papilionaceous
	sycamore		abate		complexity		quayage		mellifluous
	pavilion		spawn		proportionateness		unbias		palestra
	pleurisy		winebibber		tiffany		marline		arrogate
	discrown		slightness		putrid		tocsin		apotheosize
	bloat		phenomenal		debauch		preclusive		embracery
	determination		messieurs		rotunda		transcendentalist		milt
	spinster		aquarium		dissension		immaterialism		templet
	copperhead		centiped		coequal		gastronomist		tump
	external		restriction		tactical		anodyne		decortication
	savory		banker		vestige		trivet		homunculus
	buckboard		Finnish		caprice		conservancy		vitrifacture
	surpassing		misgotten		proboscis		comatose		pretermit
	sickishness		err		cosmetic		carpologist		deltoid
92	upholster		jade		cajolery		monetization		algoid
	reexport		leniency		hyperbolical		tatterdemalion		stannary
	alternate		layering		whitleather		iridium		endemical
	dromedary		abduction		attainability		wady		nereis
	jugular		deplorably		binnacle		malleate		ryot
	nobby		venom		sere		henna		magian
	infidel		overmaster		scholasticism		materia medica		gymnotus
	Olympic		humanitarian		effusiveness		bogle		acescent
	agate		subsist		clearstarch		autonomic		adytum

*Through an error in printing the word *skeleton* occurs twice.

The number of words which any grade should know from the list is found by dividing the average vocabulary of the grade by 140. Accordingly grade II should be able to use 29 words; grade III, 39; grade IV, 49; grade V, 59; grade VI, 69; grade VII, 82; grade VIII, 92.

None of the last 25 words were used correctly by any pupil; that is, 12½ per cent. of the words in Webster's Academic Dictionary are entirely foreign to high school pupils. There were, naturally, many errors made in the attempted use of words which were not due to real inability to use the words. The following examples taken from the test sheets are suggested as explanatory of such mistakes: (1) Those due to imperfect visual imagery; *e. g.*, "They sold the lubber from the whale," "Psalm trees grow here." (2) Errors due to imperfect auditory imagery; *e. g.*, "Our you a boy?" "I will potent I am dead." (3) Errors due partly to both imperfect auditory and visual imagery; *e. g.*, "The horse is a cosmetic animal," "I pulled the spinster out of my foot." (4) Errors due partly to confused auditory and visual imagery, and partly to lack of familiarity with the word; *e. g.*, "She made her debauch at the party" "It is an autonomic gun." Of course, there is no hard and fast line between these four types of errors. It may seem strange that any errors should be due to auditory imagery since the words were not pronounced to the pupil; but in such cases as the confusion of "our" and "are," since there is little similarity in the appearance of the two words, it seems probable that the pupil images the sound of the word and thus confuses it with a word similar in sound.

Possible Factors in the Acquisition of a Vocabulary

Of the two factors operating in a greater or less degree in practically all mental processes, native endowment and environment, it is generally held that the latter is more important so far as the acquisition of a good vocabulary is concerned.

The most prominent environmental factors are, the home, the community, reading facilities, and travel. An effort was made by means of a personal study of two groups of children to determine what part each of these factors had played.

Home. It is apparent at the outset that the task of grading homes as one grades examination papers is an exceedingly complicated one. Each home represented in the first group of children, called Group A, was visited in order to arrive at an estimation of the home

life on the basis of such characteristics as, occupation of parents, economic status, books and magazines, and general intellectual tone. The homes were then graded as "Excellent," "Good," "Fair," and "Poor." Of the 32 homes, 7 were graded E. Two of the seven children from these homes had vocabularies at, or below the average for the group, while four were in the highest 25 per cent. of the group. In 82 per cent. of the cases the correspondence between groups was close; that is, the pupils from "Excellent" homes had "Excellent" or "Good" vocabularies and those from "Poor" homes had "Poor" or only "Fair" vocabularies. In 18% of the cases there was entire lack of correspondence. For example, the pupil having the third highest vocabulary in the group came from a "Fair" home and the pupil who ranked eighth in vocabulary came from the poorest home in the whole group.

With reference to Group B the fact that all but two of the 25 children were from homes of professors or instructors in the University is sufficient characterization of the homes from which they came. Combining this with the fact that eight of the pupils in the group had vocabularies below the average of their respective grades, we see that the correspondence here between the character of the home and size of vocabulary cannot be close.

So far as the evidence here goes, it points to the conclusion that, while the home is generally an important factor in the acquisition of a good vocabulary, it is not in all cases the determining factor.

Community. With the community, as with the home influence, we are dealing with a number of factors instead of with a single one. Probably the school is the most important element, for the child, of community influence. Since, however, it operates upon all the pupils within a grade in a uniform manner, it would tend to eradicate rather than produce individual differences. The size of the community in which pupils lived was investigated in a number of cases. It was found that the pupil who ranked highest of all the pupils tested, had always lived in a city of several thousand population; while the eighth grade pupil ranking highest of the eighth grade pupils had always lived in a small town. This was typical of the conditions and relations. In other words, the size of the community does not appear to be an important matter so far as vocabulary is concerned.

It might be supposed that the general intellectual tone of a community would have much to do with a child's vocabulary, but in-

asmuch as there were in Group B, in a highly intellectual community, a number of children with inferior vocabularies, it would seem that this factor is not, unless in a very general way, significant.

Reading. It can hardly be doubted that both the quality and quantity of a child's reading has much to do with his verbal ability. Frequently, in explaining a pupil's remarkable performance in the vocabulary test, the teacher would remark that he or she was a great reader. Through a study of group B in which the time spent in reading, the kind of reading, the reading and the enjoyment in reading, were considered, the following facts were ascertained:

(1) The boys read a greater variety than did the girls.

(2) The girls read more than did the boys.

(3) The boys read more humorous material, the girls more light fiction.

(4) No pupil ranked high in vocabulary who was not a great reader.

(5) No pupil ranked high who did not read a variety of literature.

(6) Some who were great readers ranked low in vocabulary.

(7) No one ranked low in vocabulary who read a great variety of literature.

It thus appears that there is a close relation between a child's reading and his command of words; but it is not so much the quantity as the quality that counts.

Travel. The published discussions of childrens' vocabularies stress the matter of travel as a productive source of new words. Travel is so invariably associated with a good home that it was impossible to determine even its approximate effect. It is reasonable to suppose that during the early stages of linguistic development, travel is an important agency in enlarging the vocabulary. After the child begins to read, however, if he has access to an abundance of good literature, it is doubtful whether he gains many words from travel that he would not get from reading. Yet it is not unlikely that his word images become more rounded out, more perfectly defined, and more definitely fixed through travel.

Accuracy in Recognition of Words and Size of Vocabulary. The recognition of a word, no doubt, depends largely upon the distinctness with which the image of the word has been created in the mind; hence an individual in whose mind clear and accurate images are constantly formed will, other things being equal, build up a vocabulary faster than one whose mentality does not function so precisely

in this respect. In order to test the validity of this theory the percentage of error in 500 test papers, selected by chance, except that boys and girls were equally represented, was calculated. Table IX gives the distribution of the 250 boys and 250 girls according to the per cent. of error in the use of words.

TABLE IX

	Less than 10% of error	From 10% to 24% of error	From 25% to 49% of error	Over 49% of error
Boys.....	7.6%	51.6%	40.4%	.4%
Girls.....	18.4%	51.2%	28.8%	1.6%
Total.....	13.0%	51.4%	34.6%	1.0%

The results here lead one to believe that girls are more accurate in the recognition and use of words than are boys. Now if the tendency to greater accuracy on the part of girls is a sex trait we should expect the girls to have larger vocabularies than the boys. We have seen that they do not. The explanation of this is probably found in the differences in environmental conditions of boys and girls. The boys having a wider range of contact with things, persons, and situations, experience a greater number and variety of images together with the various verbal symbols of these images. At the same time, on account of a greater number and variety, they necessarily experience each of these images with its verbal symbol a less number of times than they would if they came into contact with fewer things and with each thing a greater number of times. Hence the images are less accurately fixed and defined. This would be true of experience gained in reading as well. We have seen that boys read less than do girls, but that they read a greater variety of literature; *i. e.*, they come into contact with more different words in reading than do the girls, but necessarily with each fewer times. Consequently they tend to be more uncertain of their words than do the girls. Environmental conditions, then, rather than innate qualities, seem adequate to explain the greater accuracy of the girls.

Coefficients of rank correlation between size of vocabulary and accuracy in recognition of words were calculated for five groups of pupils and the results varied from .18 to .49. The fact that girls are more accurate, as is shown in Table IX, and that boys have slightly larger vocabularies, as is indicated in Table II, accounts for the low degree of correlation. The very fact, however, that

there is a fair degree of correlation between the two capacities, in spite of the influence of environment, tends to substantiate the theory that the vocabulary of an individual does depend in a considerable degree upon the readiness and accuracy with which he forms verbal images.

General Intelligence and Verbal Ability

The three views extant, with regard to the relation of thought to language are summarized by Professor Dewey (5) thus: "First, that they are identical; second, that words are the garb or clothing of thought, necessary not for thought but for conveying it; and third, that while language is not thought it is necessary for thinking as well as for its communication." The first view has had little support among eminent thinkers since the time of Müller. One of the foremost advocates of the second is Professor Preyer, who, after making an extensive study of the mental development of his child, Axel, concluded that the child did not need "words or looks or gestures or any symbol whatever in order to arrange in time and space the sense of perceptions." The third view is the one to which Professor Dewey subscribes and the one which is most generally held.

One of the first difficulties which confronts one in a discussion of the question is the lack of a generally accepted definition and understanding of the term, intelligence. Stern's definition, "Intelligence is a general capacity of an individual consciously to adjust his thinking to new requirements; it is general mental adaptability to new problems and conditions of life," (17, p. 3) is probably the most satisfactory statement for the present state of knowledge.

A second obstacle with which one has to deal is the absence of adequate means of measuring intelligence. Since there is no single test of intelligence against which serious objections have not been raised, it was thought that the most valid results would be secured by using a number of tests. The tests were given to the two groups, A and B. Group B will be discussed first as the results are more complete for it. There were 25 pupils present for all the tests given, the others being absent so much that the results were not considered. The following table shows the rankings of the pupils in each of the tests together with the final rank of each pupil in all the tests. The final rank was determined by adding together a pupil's ranks in all the tests except the vocabulary test. The smallest sum would then represent the highest rank.

TABLE X

Vocabulary	Knox Healy	Binet-Simon	Courtis Arith.	Starch Reading	Starch Spelling	Final Rank
1	17	1	5	4	1	2
2	8	3	1	1	14	1
3	23	8	7	2	3	5
4	14	2	12	7	2	4
5	5	6	8	9	5	3
6	6	23	23	13	10	18
7	15	15	21	10	4	13
8	21	7	15	11	9	12
9	22	10	4	6	8	7
10	4	9	10	5	16	6
11	18	4	14	17	6	9
12	12	13	16	20	23	21
13	20	22	21	3	24	23
14	16	5	8	8	13	8
15	13	14	3	24	7	11
16	11	11	10	23	19	16
17	19	19	18	25	21	25
18	10	12	19	16	11	14
19	1	20	19	15	20	18
20	25	24	2	22	17	22
21	9	17	13	19	12	15
22	3	16	16	21	18	16
23	2	18	6	12	22	10
24	24	25	23	14	15	20
25	7	21	25	18	25	24

The Knox-Healy* tests consist of a series of form boards, pictures, blocks, combination locks, jig saws, etc., designed to test the general intelligence of an individual as it functions in observation of form and details of a situation, in observation and memory of a series of movements, and in general manipulative and motor ability. The coefficients of rank correlation between the vocabulary test and the other tests were as follows: Binet–Simon, .66, Knox–Healy, −.11, Courtis Arithmetic, .36, Starch Reading, .67, Starch Spelling, .69. The coefficient for the vocabulary test and final rank is .69, and for average scholarship .59. The fact that there is a negative correlation between the Knox–Healy and the vocabulary test probably bears out the belief that there is little relation between verbal and motor ability. Naturally, the most significant correlation is that between final rank and vocabulary ability since the final rank in intelligence is based upon five, rather than one test.

Only 20 of the 25 in the second group were present for a sufficient

*This test was applied by Mr. Clifford Granger, a graduate student in Professor O'Shea's seminary in Education, and to him the author is indebted for the results.

number of the tests to make their results worth using, and a number of these were not present for all the tests.* It thus happens that the final ranks for a few had to be determined upon the basis of three or four different tests. The rank for each pupil in the Courtis tests is his rank in the four tests in the fundamentals. The "A" test was given once a week for a period of eight weeks and the rank is indicative of the rate of improvement during the period. The two composition tests were given to discover the range of words for each pupil in writing a fifteen minute composition on a familiar topic. In the association test twenty simple words were pronounced at intervals of one minute, the pupil writing down during the time all the words which came to his mind. His rank depends upon the number of different words which he wrote.

The coefficient of rank correlation between the vocabulary test and the final ranks in Table XI is .60. It is not felt that this coefficient is so significant as was the corresponding one in the former group since the tests are predominantly verbal tests.

TABLE XI

Vocabulary	Comprehension in reading	Speed and Comprehension in reading	Courtis Arithmetic	"A" test	First Composition	Second Composition	Association test	Final rank
1	1	2	..	2	4	1	..	1
2	..	..	17	..	..	8	4	12
3	2	4	4	1	7	5	5	3
4	15	11	18	5	..	..	8	16
5	5	7	8	..	5	6	5	5
6	10	12	15	..	..	..	3	13
7	5	3	2	7	..	2	2	2
8	4	1	13	11	..	17	1	7
9	2	8	3	..	6	3	..	4
10	7	5	6	..	11	7	12	9
11	..	..	10	3	8	10	9	8
12	12	10	1	4	1	14	7	6
13	16	15	9	..	..	13	..	20
14	13	16	6	10	12	9	11	14
15	..	..	15	9	10	16	10	17
16	8	13	10	6	2	11	14	11
17	19	13	..	8	3	12	13	15
18	..	..	4	..	9	4	15	10
19	14	9	12	12	13	15	16	19
20	10	5	13	..	14	18	..	18

*For the privilege of making the studies of this group, as well as for some of the material here used, the author is indebted to Professor V. A. C. Henmon.

It is now possible to make a sort of survey of the whole study and note some of the prominent indications. It has been shown that there is a large degree of correlation between a pupil's ability in oral expression and his vocabulary ability. It frequently happens that a child who is quiet and reserved does not get credit for a good vocabulary when he possesses one, while the child who talks freely is rated by the casual observer as a better linguist than the former though he may have a meager fund of words. In Group A, for example, the pupil ranking 19 in vocabulary is an incessant talker, but the number of words used in a given time, either in speaking or writing, is relatively small. Moreover, her expression, when carefully analyzed, is neither meaningful nor elegant. In Group B the pupil who ranks tenth in vocabulary is also of this type. The teacher experiences continual difficulty in keeping him from talking constantly in the recitation; while the pupil who ranks first in vocabulary is quiet, reserved and reflective. In speaking, the former is impulsive, inaccurate and inelegant while the latter is accurate, careful and discriminating.

With written expression the case is fairly similar. A number of regular school compositions from Group B were examined and, with very few exceptions, in which the deviations were not large, it was found that the pupils ranking high in vocabulary expressed their thoughts in more and better chosen words than did those whose vocabularies were below the average.

The main question with relation to the correspondence between language ability and average scholarship grades is, in what degree are average scholarship grades indicative of general intelligence? Some psychologists maintain that school performance is to no extent, or at least only to a very small extent, indicative of intelligence. Naturally, it cannot be affirmed that school grades are absolute and accurate measures of intelligence. The fact that practically all mental tests agree in indicating much greater individual differences than school grades show, is good evidence that school grades are not finely discriminating. This fact, however, does not mean that school activities do not test intelligence, nor that school grades are not, on the whole, indicative of mental capacity. School grades are to some extent determined by matters of expediency and economy in school administration and organization; but the statement so often made, that regular school activities are too narrow to test the various phases of the child's mental

capacity, lacks verification under present day school conditions. The facts already established by this investigation, of the high correlation between size of vocabulary and average school grades on the one hand, and between size of vocabulary and various mental tests on the other, tend to substantiate the assertion that average scholarship grades are indicative of general intelligence.

Now if this is established, it follows that the size of one's vocabulary under normal conditions is also a fairly accurate measure of his general mental capacity. This conclusion is supported by the results of studies of groups A and B, where it is found that, if several types of tests are given and the estimates of intelligence based upon the results, there is a good correlation between these results and verbal ability.

What, then may we conclude as to the exact relation between language and thought? We have referred to Preyer, who contends that the child shows evidence, through various activities, of extensive thought processes or deliberation before he acquires the use of language. As opposed to this view, it has been shown by Morgan (11) that animals often carry on activities which apparently imply just as complex thought processes as are necessarily connected with the cases cited by Preyer. Is it not then probable that whatever mental activities the child performs before he learns the use of language are precisely comparable to those which are common to the higher types of animals? Morgan says, "Language, and the analytical faculty it renders possible, differentiates man from the brute" (11, p. 374). Baldwin makes a similar statement when he says that with the getting of concepts "as opposed to the recepts of the animals . . . goes the development of speech, which some psychologists consider the source of all man's superiority over the animals" (1, p. 42). It cannot be doubted that animals have extensive processes of imagery and associations, but it is also true that there is a distinct difference between them and the mental processes of a rational human mind. Now this difference seems to be due to the capacity of the human mind for generalization, a capacity which is quite dependent upon symbols. And just to the extent to which these symbols make generalization possible, will this generalization be able to extend itself. Evidently then, the degree of intelligence which an ordinary person would manifest in consciously thinking out his reaction to any given stimulus, depends upon just how extensively the process of generalization has been

carried out. Without language, which is a highly refined system of symbolism, the generalizing process certainly cannot proceed. The child before learning to use words, and to some extent man throughout life, carries on the same sort of deliberation that the lower animals do, that of a very simple, direct, and concrete association. After he begins to learn words and, in fact, coincident with the word learning process, comes the conceptual activity. Morgan would even deny the child mind without language real percepts, preferring the term "mental products of a perceptual order." It is, however, quite certain that he does not account for the difference between child mind and brute mind which is apparent before the child begins to use language directly, that is, the manifest tendency of the child mind to generalization of experience, shown in anticipatory conduct. This is pointed out by Baldwin. This anticipatory conduct, which is the process or tendency of the mind in predicting results or acts through apperception, simply implies the indirect use of the language the child hears in organizing his own experience before he is able to make the speech organs function properly. This, then, leads to the conclusion that a "vague and confused" sort of generalization is taking place in the child mind before he uses language in a direct manner; whence it becomes perfectly clear that speech and thought are developing side by side in the child, each aiding and reenforcing the other. Just this lack of the indirect speech element is what seems to distinguish the brute mind from the human mind without language.

Now it seems perfectly rational, to repeat our former statement, that in any individual intelligence is conditioned by the extent to which he has carried out the generalizing of his experience, the building up of his conceptual order, which is, as we have just seen, almost wholly dependent upon the degree in which he is able to use highly refined symbolism. We may say, then, that language becomes a kind of filing case in which experience is sorted out, classified, and organized, and that without it, mental associations must remain of a primitive, direct, and simple type.

Pedagogical Aspects

From a number of investigations (6, p. 117; 2; 3) it has been determined that normal children from three to five years of age utter, under ordinary circumstances, from 1000 to 1400 words per hour during the entire day. In the author's study of child language

this has been verified both in the case of a three-year-old child and in that of one four and one-half years. In this particular study it was also found that the child of four and a half years, if allowed perfect freedom in talking, was not linguistically inactive for a period exceeding three minutes at any one time during the entire day. From the very nature of our present school system such freedom and continuity of oral expression is impossible, even if desirable. To discover in what degree children in the school room do have opportunity for oral expression and what the character of the expression is, the author spent 70 hours observing this phase of language work in the various grades. In a fourth grade, where 15 hours were spent, the highest number of words spoken per hour by pupils was 992, the lowest 416, and the average 705. The average number of pupils present during the time was 25. These words include words uttered in oral reading, although periods were chosen in which there was comparatively little of this. Ten periods were spent in kindergarten or primary grades with similar results as to number of words spoken; the remainder of the time was spent in the upper grades. In all grades under normal conditions the rate of speaking for hour periods seemed to be about the same as that given above. In the upper grades, naturally, there were longer periods of silence and the rate of speaking by pupils was at times much greater. It seems obvious that the number of words spoken by pupils cannot greatly exceed these estimates since the teacher generally talks at least one-half the time. Now if the number of words spoken per hour, as indicated here, be divided by 25, the number of pupils in the room, it is seen that the average for each pupil is, at most not over 40 words per hour. What happens is, of course, that a few pupils talk a great deal while several say little or nothing. The question at once arises, if there is an expressive instinct, or a natural tendency to expression which prompts the child to tell his experiences to his associates, to respond verbally to all sorts of stimuli continually, to what extent may the school without danger repress this tendency. Teachers often ask why pupils become timid at a certain period and reluctant to get up and speak or recite. The explanation appears to be found largely in this continual repression of the natural impulse to communication. The timidity does not appear suddenly or at any definite period but is the result of a gradual growth which is fostered and nourished from the day the child enters school. The child is reproved re-

peatedly because he speaks either to the teacher or to other pupils without permission and finally he often comes to associate a feeling of timidity with speaking in school. In many cases this association is built up to such an extent that there is a distinct feeling of unpleasantness, even of dread, upon the part of the pupil upon hearing his name called in recitation. Some repression is undoubtedly beneficial; pupils must learn to listen attentively as well as to speak accurately; they must learn that others have a right to be heard. Nevertheless, it can hardly be doubted that the process through which pupils are compelled to inhibit this social tendency should be a more gradual one and it is very doubtful if it should ever be carried so far as it is in the present school system.

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AN ABSOLUTE POINT SCALE FOR THE GROUP MEASUREMENT OF INTELLIGENCE.—PART II.

ARTHUR S. OTIS

Surgeon General's Office, Washington, D. C.

VII. Overlapping of Ability Between Grades

The points in Fig. 1 belonging to pupils in the eighth grade were made as circles, those belonging to pupils in the sixth grade, crosses, and those belonging to pupils in the fourth grade, triangles. It will be noted that there is considerable overlapping between the grades even though they are not consecutive.

The average score of the fourth graders is 385, of the sixth graders, 514; and of the eighth graders, 605. Suppose we call the norm for the third grade 320, the norm for the fifth grade 450, and for the seventh grade, 565, as shown in Fig. 1. We then find 8 fourth graders out of 43 above the fifth grade norm. Presumably these could do satisfactory fifth grade work. We find 1 of these 8 above the sixth grade norm. And we find 4 fourth graders below the third grade norm. The scattering of the three grades is shown in Table VI.

TABLE VI

Showing the Overlapping between the Grades

Norms:	3rd	4th	5th	6th	7th	8th
Fourth Grade (43)	4	19	12	7	1	
Sixth Grade (40)			5	11	15	4	5
Eighth Grade (38)				3	5	10	20

Another rather interesting fact concerning the distributions of scores, particularly in the sixth grade, is that there is a tendency for the more mature* pupils, intellectually, to be the younger ones. It would seem from this and the many other similar investigations that this is invariably the case. The most mature pupil in the sixth grade is, in fact, next to the youngest, while the oldest is next

*It has been necessary in this case to avoid the use of the ambiguous word, intelligence, which is used by nearly all writers on mental testing to mean both maturity, irrespective of age, and brightness—maturity with respect to age. The statement that, in a single grade, the youngest are also the most intelligent, according to the second meaning, would be a mere platitude. This would be true even if there were zero correlation between age and maturity.

to the least mature. In the eighth grade, also, the youngest is more mature, intellectually. There is, in other words, a negative correlation between age and maturity in the single grades. If pupils were graded according to intellectual maturity only, there would be no appreciable correlation, positive or negative, between age and maturity in a single grade. The act of negative correlation, therefore, suggests strongly that some bright pupils (mature but young) have been held back by the inelastic system of grading and that dull pupils have been promoted beyond their ability. This is one of the evils which mental testing should eventually remedy.

VIII. The Refinement of the Scale

Finding the Order of Difficulty of the Elements of the Tests. While not essential, it is nevertheless very desirable to have the elements of each test arranged in the order of difficulty. The relative degrees of difficulty of the elements of a test are, of course, probably not the same for any two individuals. The best arrangement, however, is probably the order of the elements according to the number of individuals who pass each, beginning, of course, with the easiest. In order to determine this ranking, the number of individuals who failed in each element was found during the scoring, for the Spelling, Arithmetic, Synonyms, Proverbs, and Relation Tests. To give an idea of the distribution of difficulties of the elements of these five tests in Scale 1, Fig. 3 was made. The horizontal position of each circle represents the number of individuals who failed in a given element. The circles at the left, therefore, represent easy elements. It is apparent from this as well as other sources that the Spelling Test is too easy for this group of individuals. The elements should be of such difficulty that the median element, in difficulty, is passed by about 50% of the group. The Synonym Test is somewhat too easy. The Arithmetic problems appear to fall into two distinct groups in difficulty. Problems of medium difficulty should be substituted for some of the others. The distributions of difficulty in the Relation and Proverb Tests are, perhaps, fairly satisfactory.

The Diagnostic Value of the Single Test Elements. It is not deemed within the scope of this study to investigate the value of each element of each test, as for example, a single problem in Arithmetic, as a measure of general ability such as is measured by the total point score of an individual, or of general arithmetical ability as measured

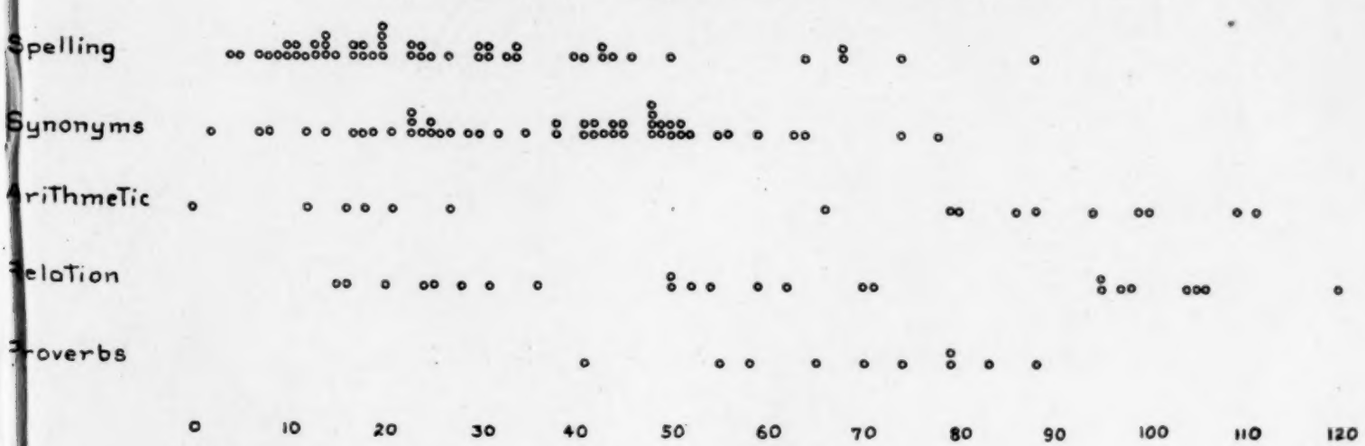
by the arithmetic score. However, as suggestive of means by which this may be done, we have examined the sixteen elements of Arithmetic Test I with the view to discovering which were the most suitable to be included in a test designed to be part of a scale for measuring general ability.

The method employed was as follows: The 121 individuals were first ranked in order of their total point scores. The papers of the 121 individuals in the Arithmetic Test I were then arranged in the same rank order. The sequence of passings and failings of Problem 1, Problem 2, etc., were noted. These are represented in Fig. 4 for each of the 16 problems and for the 121 individuals. There is one dotted line for each problem; each dotted line contains 121 units, one for each individual in the order of their total point scores. The presence of a unit of line indicates a problem correct; the absence of a unit line indicates a problem failed. The lines are arranged in the order of difficulty of the problems beginning with the easiest, the numbers of the problems represented are given at the left. The number of passes for each problem is represented by the position of a small circle on the line. In this figure the relative values of the problems as measures of general ability are shown by the relative amounts of overlapping of passes and failures—the greater the overlapping, the less the diagnostic value of the problem.

If the range of abilities of the individuals tested had been sufficiently broad so that the complete range of overlapping was represented for each problem, it would be a comparatively simple matter to express the relative diagnostic value of each problem by a single

FIG. 3

Showing the Distributions of Difficulties of the Elements of Five Tests



number. For example, let us suppose that no individuals having measures of general ability above those represented in the figure would fail in either of Problems 7 and 8 and that no individuals having measures of general ability below those represented would solve either of these problems. If there were no overlapping in either case a full line would extend just to the circle representing the total number of passes, these being 94 and 55 respectively. Since in line 7 there are 10 failures before and 10 passes after the circle, we could represent the amount of overlapping by the number 10. Similarly since in line 8 there are 23 failures before and 23 passes after the circle, could represent the amount of overlapping in this case by the number 23. A rank order of the problems according to these numbers would, under the conditions mentioned above, give a serviceable indication of the comparative diagnostic values of the problems.

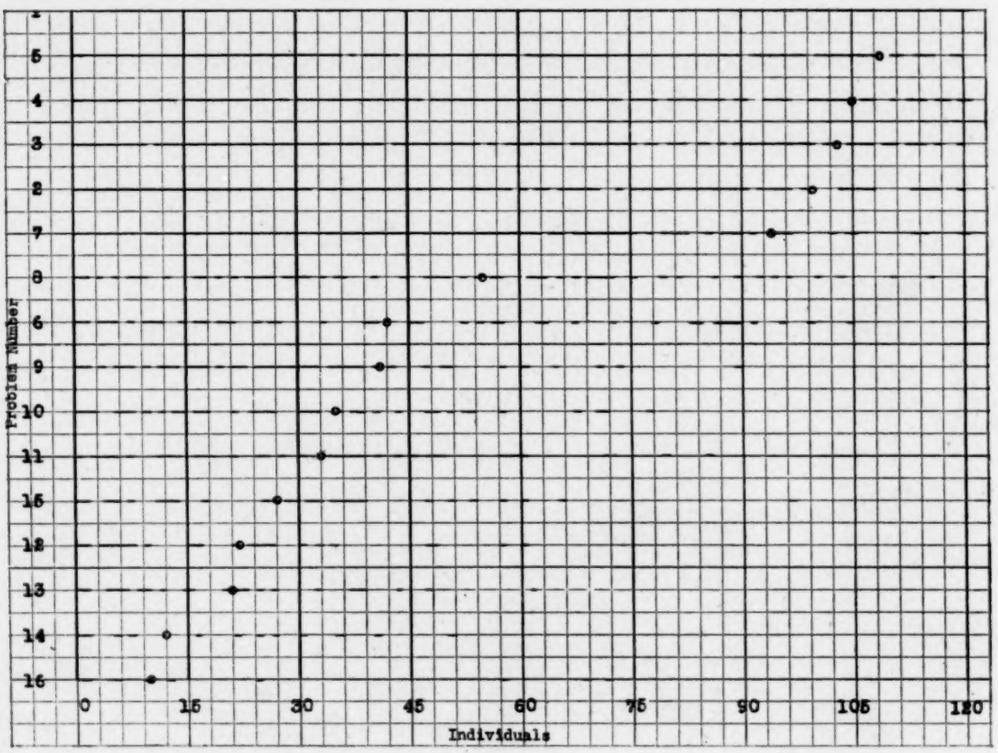


FIG. 4

Showing the Rank Order in Intelligence of the Individuals who Passed Each Problem of Arithmetic Test I.

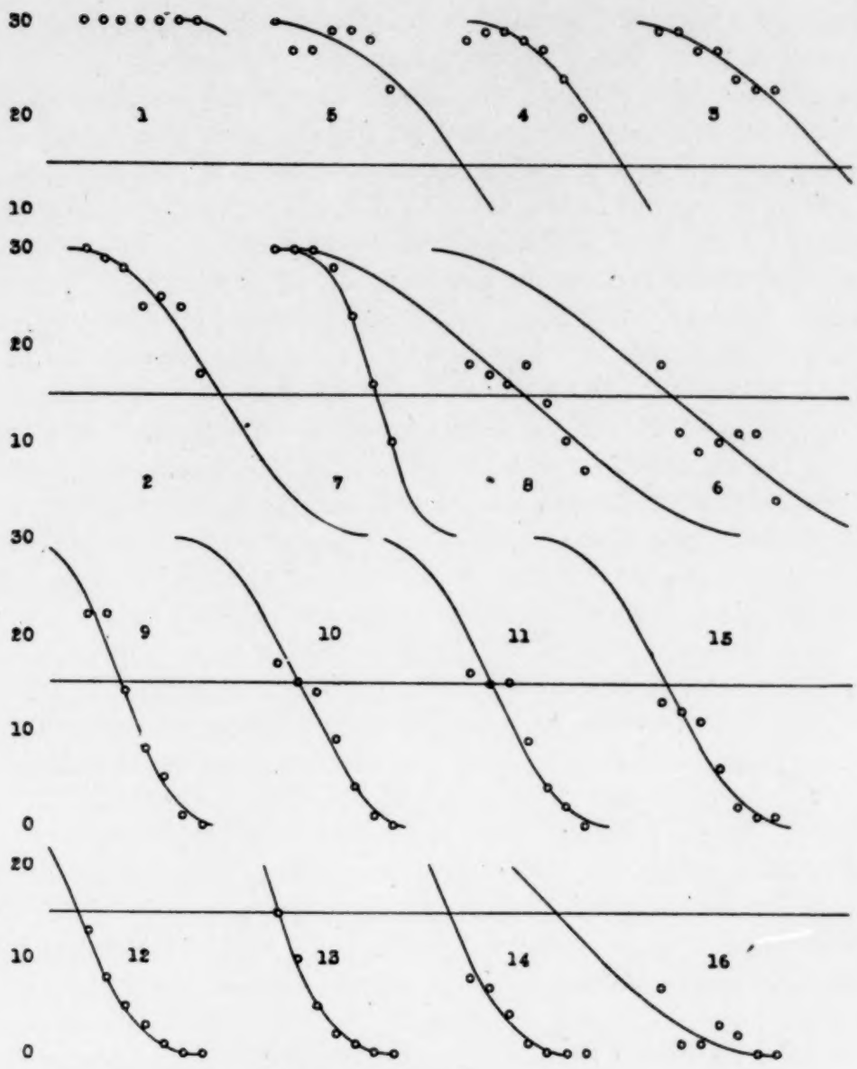


FIG. 5

Showing the Diagnostic Value of Each Problem of Arithmetic Test I

Inasmuch, however, as only a portion of the overlapping is represented in each case, it becomes necessary to adopt further means of ascertaining the relative diagnostic values. A method offering greater refinement is illustrated in Fig. 5. In this figure each group of seven circles pertains to one problem. The heights of the first circle, according to the scale at the left, represents the number of passes by the first 30 individuals in rank order. The height of the second circle represents the number of passes by individuals 16 to 45, inclusive, the third circle, individuals 31 to 60, etc., embracing 30 individuals in each group, the last group being 91 to 120. There is, of course, a tendency in each case for the succeeding numbers of passes to decrease. Theoretically, there should be a tendency for the circles to lie in a smooth curve of the form of an ogive. The steepness of the curve would indicate the degree of diagnostic value of the problem. The merit of this method is that it is possible in many cases to obtain a fairly good idea of the true slope of the curve for a given problem from only partial data. Curves have been drawn in what was judged by the eye to be approximately the true position of the curve. The problems may now be ranked in diagnostic value according to the slope of the curve at the 50% point. Thus it will be seen that the diagnostic value of Problem 8 appears to be the best. The value of Problem 1, of course, cannot be found. Quite possibly it would be as good as the average for lesser degrees of ability. For this group of individuals, of course, it has no value except perhaps for illustrated purposes. With the exception of Problems 6 and 7, possibly of 3 and 16, it would seem that the diagnostic values of the problems may be considered satisfactory.

It should be noted that the horizontal position of the point at which the curve crosses the 50% line affords a refined measure of the degree of general ability to which the ability to solve the problem corresponds. Thus, Problem 8, for example, may be considered "standard" for the degree of general ability slightly less than that of the 90th individual in rank order, say of the 93rd; or of 600 points. This method is practically that suggested for the standardization of tests of the Binet Scale (see Ref. 15). To thus express the degrees of difficulty of the several problems in terms of the Absolute Scale would assist in making the increments of difficulty between the problems equal. Such an amount of refinement, however, is not considered to be of great value until more of the obvious defects of the scale have been eliminated.

To determine the relative values of the problems as measures of "arithmetical ability," it would be necessary, of course, merely to rank the papers in the order of the arithmetic scores instead of the total scores.

IX Inter-Test Correlations

Considering the fact that double measures were obtained of each ability tested and that the number of individuals was comparatively large, it was deemed valuable to obtain the inter-test correlations. These are given in Appendix IV. They are correlations between measures obtained in each case by combining the results of the two tests of a kind. There are given both the same coefficients and those corrected for attenuation due to errors of measurement. The formula used for correcting for attentuation was as follows (see Ref. 3).

$$r_{ab(corrected)} = \frac{r_{ab(raw)}}{\sqrt{r_{aa}\, r_{bb}}}$$

It is considered necessary to leave the discussion of the inter-correlations to a later article.

X. Further Considerations Regarding Reliability

The Reliability Coefficient of the Point Scale. To find the reliability coefficient of correlation between Scale I and Scale II, we may proceed as follows. Let us call the ten tests of Scale I a_1, b_1, c_1, - - - j_1, and those of Scale II, a_2, b_2, c_2, - - - j_2. Then by the formula (See Ref. 13) for the correlation of the sums of several variables, the standard deviations of the distributions of scores in the several tests having been made equal,

$$r_{(a_1+b_1+c_1+\cdots+j_1)\,(a_2+b_2+c_2+\cdots+j_2)} =$$

$$\frac{r_{a_1a_2}+r_{a_1b_2}+r_{a_1c_2}+\ldots+r_{b_1a_2}+r_{b_1b_2}+r_{b_1c_2}+\ldots+r_{c_1a_2}+r_{c_1b_2}+r_{c_1c_2}+\ldots}{\sqrt{10+2(r_{a_1b_2}+r_{a_1c_1}+\ldots+r_{b_1c_1}+\ldots)}\ \sqrt{10+2(r_{a_2b_2}+r_{a_2c_2}+\ldots+r_{b_2c_2}+\ldots)}} \quad (1)$$

$$= \frac{\text{(Sum of 10 reliability coefficients, } r_{a_2a_2}\text{, etc.)} + 2\text{(Sum of 45 coef. of intercorrelation, } r_{a_1b_2}\text{, etc.)}}{\sqrt{10+2\text{(Sum of 45 coefs. of intercor., } r_{a_1b_1}\text{, etc.)}}\ \sqrt{10+2\text{(Sum of 45 coefs. of intercor., } r_{a_2b_2}\text{, etc.)}}}$$

But since the correlations, $r_{a_1b_1}$, $r_{a_1b_2}$, and $r_{a_2b_2}$, tend to be equal, we may take the sums of each of the three sets of 45 coefficients of

correlation to be equal to one another. We may therefore simplify the equation thus:

$$r_{(a_1+b_1+c_1+\ldots_1+j_1)\ (a_2+b_2+c_2+\ldots+j_2)} = \frac{\Sigma r_{xx}+2\Sigma r_{xy}}{10+2\Sigma r_{xy}} \qquad (2)$$

in which $r_{xy}=r_{aa}+r_{bb}+r_{cc}+\ldots$

and $r_{xx}=r_{ab}+r_{ac}+r_{ad}+\ldots+r_{bc}+\ldots$

Since the intercorrelations were found between *double* measures in each test, it is necessary to express the reliability coefficients also in terms of double measures. As these were found in terms of single measures, each has been transmuted into terms of double measures by means of the formula,*

$$r_{2a2a}=\frac{2r_{aa}}{1+r_{aa}} \qquad (3)$$

in which r_{2a2a} and r_{aa} are respectively the correlations between double measures and between single measures of any ability. The reliability coefficients in each test in terms of double measures are shown in the fourth column of Table III. Their sum (Σr_{xx}) is shown to be 8.877. The sum of the 45 coefficients of intercorrelation multiplied by 2 = 56.478 ($=2\Sigma r_{xy}$). Solving formula 2 above,

$$r_{(\text{Scale } I_2)\ (\text{Scale } II_2)}\ \frac{8.877+56.478}{10+56.478}=.983.$$

This is when Scale I_2 and Scale II_2 are considered as double scales. To find the reliability coefficients of correlation between Scale I and Scale II as single scales, *i. e.*, each composed of the tests truly comprising it (call these Scale I* and Scale II*), then, according to the formula,†

$$r_{aa}=\frac{r_{2a2a}}{2-r_{2a2a}}$$

in which r_{aa} and r_{2a2a} have the same meanings respectively as before,

$$r_{(\text{Scale } I_1)\ (\text{Scale } II_1)}=\frac{.983}{2-.983}=.967$$

This, then, is the reliability coefficient of the Point Scale.

The Probable Error of the Point Scale

As has been shown (see Ref. 11)

$$r=1-\frac{\sigma_e^2}{\sigma_{dist.}^2} \qquad (1)$$

*This formula is a corrollary to formula 1 above.

†The inverse of formula 3.

in which r is the reliability coefficient of correlation between two series made up of pairs of measures, a_1, a_2; b_1, b_2; c_1, c_2; etc.; in which σ_e is the standard deviation of the errors of measurement of a, b, c, etc.; and in which $\sigma_{dist.}$ is the standard deviation of the distribution of values, a, b, c, etc., in either series.

From equation 1 it follows that

$$\frac{\sigma_e^2}{\sigma_{dist.}^2} = 1 - r \text{ whence } \sigma_e^2 = (1 - r)\,\sigma_{dist.}^2$$

$$\sigma_e = \sqrt{1 - r}\,\sigma_{dist.} \qquad \text{and} \qquad P.E. = .6745\sqrt{1 - r}\,\sigma_{dist.} \qquad (2)$$

in which *P. E.* is the probable or median error of measurement.

If, now, we consider r to be the reliability coefficient of the Point Scale, P. E. as the probable error of measurement by either Scale I or Scale II, and $\sigma_{dist.}$ as the standard deviation of the point scores by the same scale, then we may solve equation 2 for the probable error of the scale. The standard deviation of the distribution of scores by the scale (average of both) was found to be 111 points. Solving equation 2,

$$P.E. = .6745\sqrt{1 - .968} \times 111 = 13.7$$

The Probable Error of the Point Scale, therefore, is 13.7 points.

This is 2.7% of the median score (500) of the whole group, or 3.0% of the total range of scores (461).

To view the reliability of the scale from another angle we may determine as nearly as possible the probable error of a mental age by the scale. Thus, if we may assume that the reliability co-efficient of correlation between mental ages by the scale is approximately equal to the reliability coefficient of correlation between the point scores and that the distribution of mental ages by the scale is approximately equal to the distribution of ages, then we may let P. E., in formula 2 above, represent the probable error of a mental age by the scale, r represent the reliability coefficient of correlation between mental ages by the two scales, and $\sigma_{dist.}$ represent the standard deviation of the distribution of mental ages. Then substituting in equation 2 the approximate values of these quantities, the standard deviation of the distribution of ages being 28.1 months, we have

$$P.E. = .6745\sqrt{1 - .967} \times 28.1 = 3.44$$

The Probable Error of a mental age by the Point Scale may be considered, therefore, as approximately 3½ months. This is practically the same as the probable error of a mental age by the Stanford Revision of the Binet Scale (see Ref. 11).

XI. Comparisons with School Mark and Amount of Schooling

Correlation of Total Score with School Mark. The teacher of each of the grades furnished for each pupil a final mark representing the relative character of his school work for the year. As the marks given by the different teachers were not comparable, a separate correlation was made for each grade between the school mark and the total point score. The coefficients were found for the fourth, sixth, and eighth grades to be respectively .80, .41, and .50. Since we have no measures of the reliability of the teachers' marks we are unable to determine the probable true correlation between intelligence, as measured by the scale, and school performance.

The Relation of the Coefficient of Brightness to the Amount of Schooling. The pupils were asked to tell the length of time they had spent in each grade. From these data, the total amounts of time spent in school was found for each pupil. For convenience, the 121 pupils were then classed together in groups according to the amount of retardation or advance. The number of the pupils of each class are shown in Table VII. Here again we have no measure of the reliability of the reports of schooling and are therefore unable to determine the value of the results. There is, however, a very definite tendency for advanced pupils to obtain high coefficients of brightness and for retarded pupils to obtain low coefficients of brightness.

TABLE VII

Showing the Amounts of Retardation and Advance and their Relation to the Coefficients of Brightness. (Data from 10 pupils were missing.)

	Retarded			At	Advanced	
	3 yrs.	2 yrs.	1 yr.	Grade	1 yr.	2 yrs.
Number of Pupils	2	8	33	56	8	4
Average Coef. Brightness	77	88	96	102	103	114

Appendix III.

Some Mathematical Reasoning with Regard to Criteria of Tests of Intelligence.

1. If we were to assume that each test measured only a general factor—one common to all the tests—and one or more factors specific to that test alone, then the relative degrees in which two tests correlate with the general factor, are expressed, subject to the

chance errors of the coefficients, by the relative degrees to which these two tests correlate with the other tests. This may be shown as follows. By formula for partial correlation,

$$r_{ac.i} = \frac{r_{ac} - r_{ai}\, r_{ci}}{\sqrt{(1 - r_{ai}^2)\ (1 - r_{ci}^2)}}$$

in which *a* and *c* are tests, *i* is a hypothetical, perfect measure of the general factor, r_{ac} is the coefficent of correlation between *a* and *c*, etc., and $r_{ac.i}$ is the coefficient of correlation between *a* and *c* which is due to factors other than the general one. But since by hypothesis, the general factor in the only source of correlation, $r_{ac.i} = 0$.

Then $r_{ac} = r_{ai}\, r_{ci}$

and similarly, $r_{bc} = r_{bi}\, r_{ci}$

Therefore $\frac{r_{ac}}{r_{bc}} = \frac{r_{ai}}{r_{bi}}$

Similarly, $\frac{r_{ai}}{r_{bi}} = \frac{r_{ad}}{r_{bd}} = \frac{r_{ae}}{r_{be}} = \frac{r_{af}}{r_{bf}} = \text{etc.}$

An expression for the combined value of these ratios is given very approximately by the ratio of the average intercorrelation between *a* and the other tests to the average intercorrelation between *b* and the other tests.

2. Let us consider now a case in which there is no factor common to all the tests in the group. To take a very simple example, let us suppose we have four tests (nos. 1, 2, 3, and 4) testing abilities each of which is made up of five of the nine elements, A, B, C, D, E, F, G, H, and I, distributed as follows.

Test 1,	A	B	C	D	E				
Test 2,	A	B	C	D		F			
Test 3,			C	D	E	F	G		
Test 4,		B			E	F		H	I

Here it will be noted that no element is common to more than three abilities. Now the coefficient of correlation between two series of values is a measure of the percentage of elemental causes common to both.* And since the number of elemental causes common to

*For example, if five coins are tossed *n* times and each time the number of heads appearing is recorded, and if after each independent tossing, one coin is left lying, the other four tossed again, and the number of heads then appearing is recorded; then as *n* approaches infinity, the coefficient of correlation between the number of heads appearing by the independent tossing and the number of heads appearing by the dependent tossing approaches .20, attesting to the fact that one fifth of the causes affecting the number of heads in each throw (one coin in five) was common to both throws of a pair. If two of the five coins are left lying, the correlation will approach .40, if three are left lying, .60, if four, .80, and if five, of course, 1.00. Similarly for other numbers of coins and similarly for elements of abilities.

abilities, 1 and 2, is four out of five, the correlation between tests, 1 and 2, will tend to be .80. Three elements are common to abilities, 1 and 3, and 2 and 3. Therefore the correlations between tests 1 and 3 and between 2 and 3 will tend to be .60. And so on. The correlation table will therefore appear as follows.

Tests	1	2	3	4
1		.80	.60	.40
2	.80		.60	.40
3	.60	.60		.40
4	.40	.40	.40	
Sums	1.80	1.80	1.60	1.20

A table showing the number of elements common to each pair of abilities would appear as follows.

Tests	1	2	3	4
1		4	3	2
2	4		3	2
3	3	3		2
4	2	2	2	
Sums	9	9	8	6

It may be seen from this table that the number of times the elements of ability, 1, appear in the other three abilities is 9. The correlation spread of ability, 1, may therefore be said to be represented by the number 9. The number of times the elements of abilities, 2, 3, and 4, appear in the other three abilities are respectively 9, 8, and 6. We may say, then, that the relative values of the correlational spreads of the four tests are as 9 : 9 : 8 : 6. Now it may be seen that these are exactly the same proportions as 1.80 : 1.80 : 1.60 : 1.20, the sums of the coefficients in the first table. The latter values are equal respectively to the former values when each is divided by 5, the number of elements in each ability. Thus it may be seen that the sums of the correlations of each of the tests with all of the others afford meaures of the relative correlational spread of the tests.

3. The coefficient of correlation between any one weighted test and the weighted composite of a number of tests may be found

from the coefficients of intercorrelation and the weights by the formula (see Ref. 13) which may be stated in general as follows.

$$r_{wa(x_1b_1+x_2b_2+x_3b_3\ldots)} = \frac{\Sigma(_x\sigma_b r_{ab})}{\sqrt{\Sigma x\,\sigma_b^2 + \Sigma xx\sigma_b\,\sigma_b\,r_{bb}}}$$

in which w_1, x_2, x, etc., are the weights given to the tests, a, b_1, b_2, etc., and σ_b is the standard deviation of the scores of any test, b.

McCall's procedure, therefore, might have been to consider b_1, b_2, etc., as representing the tests which he wished to embody in his Composite; to consider x_1, x_2, etc., as representing the respective weights to be given these tests, and a as representing any test it was desired to correlate with the Composite. The correlation could then have been obtained by solving the equation. The general formula, is equally applicable, of course, for finding, from the intercorrelations, the correlation of a test with the average of all the *other* tests.

If only the relative values of the correlations of each test with a composite of weighted tests is desired, these may be obtained more simply yet; thus, assuming that there were only three tests, a, b, and c, in the group, weighted respectively, w, x, and y, then the corresponding formula for the correlation of test a, with the weighted composite would be

$$r_{wa(wa+xb+y)} = \frac{w\Sigma_a r_{aa}+x\Sigma_b r_{ab}+y\Sigma_c r_{ac}}{\sqrt{w^2\sigma_a^2+x^2\sigma_b^2+y^2\sigma_c^2+2(w\sigma_a x\sigma_b r_{ab}+w\sigma_a y\sigma_c r_{ac}+x\Sigma_b y\Sigma_c r_{bc})}}$$

Similarly, $$r_{xb(wa+xb+yc)} = \frac{w\Sigma_a r_{ab}+x\Sigma_b r_{bb}+y\Sigma_c r_{bc}}{\text{same denominator}}$$

And $$r_{yc(wa+xb+yc)} = \frac{w\Sigma_a r_{ac}+x\Sigma_b r_{bc}+y\Sigma_c r_{cc}}{\text{same denominator}}$$

Since the denominators are the same in all cases, it may be seen that the relative values of the correlations of the several tests with the weighted composite are directly proportional to the sums of the intercorrelations of those tests, each with all the tests, when these intercorrelations have been weighted as shown in the numerators. And if the standard deviations have been made equal, this merely means weighting the several coefficients by the same weights in and the same order as they would appear in the composite. The same reasoning holds for any number of tests.

4. If it is desired, on the other hand, to find the relative or absolute amounts of the average intercorrelations of each of a series

with all the others, (weights and standard deviations being equal) as a criterion of the degree to which each test measures the common factor; and if the values of the separate intercorrelations are not required; it will be more convenient to derive these average intercorrelations from the correlation of each test with the average of all the measures taken together as a composite. That this may be done is shown as follows.

Repeating the proof given in 3 above in a simpler form, let us assume again for the moment that there are only three tests, *a*, *b*, and *c*, in the series; then by the formula for the correlation of one test with the average of a number of tests (assuming weights and standard deviations equal),

$$(1) \qquad r_{a\,(a+b+c)} = \frac{r_{aa}+r_{ab}+r_{ac}}{\sqrt{3+2(r_{ab}+r_{ac}+r_{bc})}}$$

$$(2) \qquad r_{b(a+b+c)} = \frac{r_{ba}+r_{bb}+r_{bc}}{\sqrt{3+2(r_{ab}+r_{ac}+r_{bc})}}$$

$$(3) \qquad r_{c(a+b+c)} = \frac{r_{ca}+r_{cb}+r_{cc}}{\sqrt{3+2(r_{ab}+r_{ac}+r_{bc})}}$$

Letting $\Sigma r_{a,b,c(a+b+c)}$ represent $r_{a(a+b+c)}+r_{b(a+b+c)}+r_{c(a+b+c)}$, and since $r_{aa}=r_{bb}=r_{cc}=0$,

$$(4) \qquad \Sigma r_{a,b,c(a+b+c(} = \frac{3+2(r_{ab}+r_{ac}+r_{bc})}{\sqrt{3+2(r_{ab}+r_{ac}+r_{bc})}}$$

$$(5) \qquad \Sigma r_{a,b,c(a+b+c)} = \sqrt{3+2(r_{ab}+r_{ac}+r_{bc})}$$

Multiplying equation 1 by equation 5, we have

$$r_{aa}+r_{ab}+r_{ac} = r_{a(a+b+c)} \times \Sigma r_{a,b,c(a+b+c)}$$

and similarly for all other correlational sums. Thus it may be seen that the *absolute* amounts of the sums or averages of the intercorrelations of any test with all the tests in the series may be derived from the values of the correlations of each test with the composite (weights and standard deviations being equal) without the individual test intercorrelations being found. The same reasoning holds for any number of tests. As a criteria of the degree to which any test measures the factor common to the group of

abilities tested, the test's average intercorrelation with all the tests and its correlation with the composite are of equal value, being, in fact, the same criterion. The sums of the intercorrelations of any test with all the *other* tests (excluding itself) may be obtained, of course, by subtracting 1.00 (the correlation of the test with itself) from the sum of the intercorrelations with *all* the tests.

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APPENDIX IV

Inter-test Correlations (Raw)

	Synonyms	Narrative Completion	Following Directions	Proverbs	Relation	Arithmetic	Spelling	Geometric	Disarranged Sentences	Digit
Synonyms		.798	.781	.828	.750	.722	.753	.674	.699	.322
Narrative Completion	.798		.815	.738	.742	.719	.787	.689	.654	.341
Following Directions	.781	.815		.762	.749	.686	.662	.716	.561	.420
Proverbs	.828	.738	.761		.738	.700	.686	.677	.567	.358
Relation	.750	.742	.749	.738		.746	.688	.719	.612	.282
Arithmetic	.722	.719	.686	.700	.746		.662	.687	.705	.324
Spelling	.753	.787	.662	.686	.688	.662		.632	.679	.259
Geometric	.674	.689	.716	.677	.719	.687	.632		.570	.301
Disarranged Sentences	.699	.654	.561	.567	.612	.705	.679	.570		.280
Digits	.322	.341	.420	.358	.282	.324	.259	.301	.280	
Average	.703	.698	.684	.673	.670	.661	.645	.630	.592	.321

Inter-test Correlations (Corrected for Attenuation)

	Synonyms	Narrative Completion	Relation	Proverbs	Following Directions	Arithmetic	Geometric	Spelling	Disarranged Sentences	Digit
Synonyms		.901	.881	.960	.887	.808	.769	.825	.819	.378
Narrative Completion	.901		.845	.830	.898	.779	.762	.836	.742	.386
Relation	.881	.845		.864	.858	.842	.828	.760	.723	.332
Proverbs	.960	.830	.864		.862	.780	.770	.749	.662	.416
Following Directions	.887	.898	.858	.862		.749	.798	.708	.642	.478
Arithmetic	.808	.779	.842	.780	.749		.753	.697	.793	.363
Geometric	.769	.762	.828	.770	.798	.753		.679	.655	.344
Spelling	.825	.836	.760	.749	.708	.697	.679		.748	.280
Disarranged Sentences	.819	.742	.723	.662	.642	.793	.655	.748		.329
Digits	.378	.386	.332	.416	.478	.363	.344	.280	.329	
Averages	.803	.775	.770	.766	.764	.729	.706	.698	.679	.367

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EDITORIAL

Ninth Grade Mathematics

Between the vigorous attacks of practical business men and the critical skepticism of educational theorists the advocates of the traditional courses in mathematics are having a hard time. The business men complain that the graduates of our schools fail to meet even the simplest mathematical situations in commercial and industrial life, while the scientific students of education are confirming by the results of standard tests the lack of mastery which pupils show even of those aspects of the subject which they are supposed to have been taught. The teachers of mathematics feel themselves on the defensive, and are making valiant efforts to convince an increasingly doubtful public that mathematics is the *sine qua non* of a liberal education. Particularly strenuous are their exertions to maintain the tradition that mathematics is the best of all subjects "to train the reasoning powers," and they are not at all kindly disposed to the educational psychologists for raising the question as to what that expression means, or whether it has any meaning. Incidentally, it is vastly diverting to note their efforts to "prove" the value of mathematics

by industriously collecting the opinions of eminent divines, lawyers, physicians, and politicians as to the school subjects that have helped them most in life. If this is the kind of reasoning which their mathematical training has developed, then the seeker after truth may well ask to be delivered from it.

By all odds the sanest, most thorough, most helpfully constructive discussion of high school mathematics is to be found in Professor Rugg's recent monograph on "The Reconstruction of Ninth Grade Mathematics." Professor Rugg is himself something of a specialist in higher mathematics, is the author of a valuable treatise on educational statistics, and is wholly sympathetic in his attitude toward the study. Yet, on the basis of a most admirable survey of the history and present status of the subject, and after a very extended application of standardized tests, he states that "the candid judgment, joint and several, of teachers of advanced mathematical and scientific subjects, of employers of labor, and of educational critics and reformers agrees with the conclusion of the scientific investigator who has measured results more objectively: ninth-grade mathematics cannot merely be rearranged or "reorganized." *It must be rebuilt from the ground up.*"

Professor Rugg believes that with a complete reconstruction of the ideals, the content, and the methods of instruction of the subject in accordance with present social needs and in accordance with the learning processes of children, ninth grade mathematics *may* be made to contribute valuable training in "logical thinking." Very good. So may every school subject. Two questions are yet unanswered. Is this the *kind* of "logical thinking" that is involved in the "analysis, comparison, and discrimination" demanded by the problems of practical life? Does the study of such reconstructed mathematics furnish a *higher degree* of training in the "logical thinking" involved in those problems than would such subjects as economics, politics, sociology, or commercial geography, which deal directly with the data involved in that "logical thinking"? Obviously anyone who expects to do advanced work in mathematics or in any quantitative science must have a certain amount and a certain kind of elementary mathematics. Just how much and what kind need to be more carefully determined. But in view of the very small percentage of high school students who will ever engage in any such advanced work, it is extremely questionable whether even the reconstructed mathematics advocated by Professor Rugg should be required of every ninth-grade pupil.

J. C. B.

NOTES AND NEWS

The plan for promoting more intimate relations between France and this country by offering one hundred scholarships in colleges and universities to French women is meeting with great success. The French minister of public information has formally accepted the offer, and has stated that many applications have already been made by French women. Sixty-five American institutions have already offered such scholarships, usually two each, so that opportunities will be offered for more than the original one hundred planned for. A committee of women has already gone to France to make selections and assignments, and a reception committee has been organized to meet the students when they arrive in this country and assist them in getting comfortably settled in their respective institutions.

It is stated in the press that the Boston school committee has decided that it could not allow teachers who are now eligible for a sabbatical year, and who desire to spend it in the service of the Red Cross in Europe, the half-pay which they would customarily receive if they spent their sabbatical leave in "travel and study." Perhaps the school committee has some good reason for this action, but to the casual reader it seems singularly unpatriotic, inhumanitarian and short-sighted. It would be more in accord with patriotism for the school committee to collect all the teachers that could possibly be spared and send them to France on full salary and expenses. There is certainly no more humanitarian cause at the present time than to provide the best possible care and nursing for our boys at the front. And for purely selfish ends it is hard to see how a city could get a greater return for its money than to have as many of its teachers as possible come into first hand contact with conditions in France.

There has recently appeared from the press of Houghton Mifflin Company *The Life of Naomi Norsworthy*, by Frances Caldwell Higgins, with an Introduction by Dean Russell, of Teachers College. Those who ever came in contact with Dr. Norsworthy will appreciate the author's tribute to her "genius for friendship, her brilliant intellectual gifts, and her rare power as a teacher."

It is with regret that we note the name of Professor G. W. A. Luckey, dean of the graduate school of education at the University of Nebraska, among those professors whose resignations have been requested by the board of regents on account of alleged indiscreet and disloyal utterances.

The board of trustees of the University of Illinois have authorized the establishment of a college of education and a bureau of educational research. Dr. B. R. Buckingham, statistician of the Wisconsin State Department of Education, has been appointed director of the bureau.

Superintendent Ernest C. Witham, of Southington, Conn., is giving courses in educational measurements at the summer session of the New Hampshire State Normal School, Keene, N. H.

At Northwestern University Dr. Robert H. Gault has been promoted from associate professor to be full professor of psychology.

At the University of Chicago J. Franklin Bobbitt has been promoted from associate professor to professor, and William Scott Gray and Harold Ordway Rugg from assistant professor to associate professor in the department of education.

Dr. J. H. Coursault has been appointed dean of the school of education at the University of Missouri.

Dr. C. B. Cornell, of the University of Nebraska, has been appointed assistant professor of education at the University of Kentucky.

Professor W. E. Chancellor, head of the department of social sciences, College of Wooster, will teach educational sociology and school hygiene at the summer session of the new School of Education, Cleveland, which has been formed by a combination of departments from Western Reserve University and the City Normal School of Cleveland.

Professor John Dewey, of Columbia University, has been granted a year's leave of absence, beginning in September, and will deliver a series of lectures at the University of California.

Professor J. Mark Baldwin has been appointed lecturer in the Ecole des Hautes Etudes Sociales at Paris.

Dr. Florian Cajori, dean of the department of engineering and professor of mathematics at Colorado College, has accepted an appointment as professor of the history of mathematics in the University of California.

Dr. John J. Tigert, head of the department of psychology of the University of Kentucky, has obtained a leave of absence to engage in army Y. M. C. A. work in France.

Dr. Leonard P. Ayres, who has had charge of the statistical work of the War Department at Washington, has been made a colonel and is attached to the staff of General Pershing in France.

Superintendent E. S. Kuhnes, of Langdon, North Dakota, has entered the psychological clinic of the war service.

PUBLICATIONS RECEIVED

FELIX ADLER. *An Ethical Philosophy of Life.* New York: D. Appleton and Company, 1918. Pp. viii, 380. $3.00.

In this noteworthy book one of the leading American writers on ethical and social questions gives an account of the development of his moral philosophy. In Book I we learn why the author found the orthodox Hebrew religion unsatisfactory, what a strong appeal the doctrines of Emerson made, how profoundly he was influenced by the teachings of Jesus, and how he worked out his own doctrine of ethical culture and social reform. Book II gives us his reaction to Kant's philosophy upon which his own ethical system is based. Books III and IV deal with the applications of his theory to "the three great shadows, sin, sickness and death," and to the relationships of the family, of vocational activities, of the state, and of the several states to each other. The final chapter is entitled "The Last Outlook on Life," and gives the author's final summing up of the whole problem. As an epitome of a long and useful intellectual career, and as an account of a sincere effort to reach a basis for religion which would commend itself to the open-minded scientific inquirer, the book deserves careful attention.

CHARLES A. BEARD AND WILLIAM C. BAGLEY. *The History of the American People.* New York: The Macmillan Company, 1918. Pp. xv, 674. $1.20.

The youth of the land are indeed to be envied for the superior quality of the text books in elementary history that are being offered them. The present work has several points of distinction. The dominating motive of the book is "the preparation of children for citizenship through an understanding of the ideals, institutions, achievements, and problems of our country." "In carrying out our ideal we have selected those striking features of American history which bear upon and help to explain our own age. We have conceived of the whole as a vital, moving story with certain very definite and fundamental acts and scenes. We have sought to give to the book that unity which comes from such a controlling purpose, and have subordinated to it all details and collateral matter." Almost five hundred pages are devoted to the period since the close of the Revolution. There are two chapters on American education, several on industrial development, and particular attention is paid to the growth of democracy. The book is provided with four colored plates, twelve colored maps, and a large number of interesting illustrations. The story is brought down to December, 1917, to the government control of the railways.

CARL C. BRIGHAM. *Two Studies in Mental Tests. I. Variable Factors in the Binet Tests. II. The Diagnostic Value of Some Mental Tests.* Psychological Monographs, Vol. 24, No. 1, Whole Number, 102. 1917. Pp. 254. $2.50.

In the first of these studies we have a detailed examination of the individual tests of the Binet scale, on the basis of the responses of 422 elementary school pupils. The results are discussed with particular reference to (1) the personal equation of the examiner; (2) the correlation of each test with the standing of the pupils in the grades; and (3) sex differences. In some of the tests a very considerable difference was found in the results of different examiners, and the author joins Doll, Whipple, Kuhlmann and others in warning against the indiscriminate use of the tests by untrained and inexpert examiners. The tests showed a general correlation with school grade, but gave only slight evidence of sex differences. The second study

presents the results of the examination of another group of 229 boys with twenty-three of the Binet tests and a number of supplementary tests, from the point of view of the diagnostic value of each individual test. These data furnish a valuable basis for determining the significance of various tests. The author accepts the point scale principle as the most satisfactory, but objects to the point weighting given to various tests by Yerkes and others.

WALTER M. GALLICHAN. *The Psychology of Marriage.* New York: Frederick A. Stokes Company, 1918. Pp. xi, 300. $1.50.

Partly as a result of recent studies in social biology and partly due to the revelations of psychopathology, there is an increasing appreciation of the importance of sex relationships for normal, wholesome living. It is recognized by all thoughtful students of the subject that much marital trouble is due to ignorance, and in the present book an attempt is made to set forth in simple, direct narrative the essential findings of medical, social and psychological investigations on the subject of sex. It is not the traditional volume of trite advice to newly-weds, but a serious sociological study designed to stimulate reflection on the significance of marriage for the individual and the community, and to contribute to the development of a rational sex ethics that will meet the conditions of modern life.

MARY HARGRAVE. *The Earlier French Musicians.* New York: E. P. Dutton and Company, 1918. Pp. 258. $1.50.

With the subsidence of German domination in music there is a natural increase of interest in the music of other countries, particularly of France. This little volume on the development of French music to the beginning of the nineteenth century will, therefore, be quite opportune. We find an account of Lully, the popular opera and ballet composer and favorite of Louis the Fourteenth; Rameau and the early clavecine composers, the forerunners of modern piano music; and the group of operatic composers that flourished during the Revolution and the Napoleonic period, Gretry, Mehul, Lesueur, Cherubini, and Boieldieu. Charming and entertaining as many of these men and their works are, they are worlds removed from the art aspirations of such modern French musicians as Berlioz, Bizet, Saint-Saens, Cesar Franck, Debussy and Ravel. Yet they furnish the background for the development not only of modern French music but of modern European music in general.

LETA S. HOLLINGSWORTH. *The Psychology of Special Disability in Spelling.* Columbia University Contributions to Education, No. 88. New York: Teachers College, 1918. Pp. vi, 105. $1.40.

This is a kind of study of which the science of education has been greatly in need. The purpose was to observe for a considerable time pupils of normal general capacity but deficient in one particular school subject (spelling), to diagnose their disabilities by means of psychological tests, and to devise remedies for their defects. The pupils were selected from the fifth grade on the basis of reports by teachers, and tests with the Ayres spelling scale. The degree of intelligence was determined by the Stanford scale, an elaborate analysis was made of the exact nature of the spelling defects, and the effect of specific training was carefully noted. There is a valuable chapter on the theory of spelling defects, and a survey of the literature on the subject.

BENJAMIN KIDD. *The Science of Power.* With an Introduction by Franklin H. Giddings. New York: G. P. Putnam's Sons, 1918. Pp. viii, 318. $1.50.

This posthumous book by the well-known author of *Social Evolution* will arouse keen interest in thoughtful readers, and will stimulate animated discussion. On the basis of the early events of the war, and the writings of German and English leaders the effort is made to show the "failure of western knowledge," and the breakdown of ethical standards constructed upon it. In part two the author develops the thesis that the basis of power in civilization rests not on reason but on emotion. The passion for the ideal is the master fact of social integration. The key to this new "science of power," the psychic center to the new social integration is to be found in the nature and influence of woman. This daring and original solution is buttressed by skillful argument and copious reference to contemporary discussions. The growing political and social supremacy of woman in the western world lends itself to the support of this view. The book will be eagerly read by those interested in any form of feminism

T. SHARPER KNOWLSON. *Originality: A Popular Study of the Creative Mind.* Philadelphia: J. B. Lippincott Company, 1918. Pp. xvi, 304. $3.50.

This is a rather discursive and chatty consideration of the higher thought processes involved in creative activity. The author has read widely and makes thrifty use of the results in extensive quotations. In his own words his object is "first, to show the importance of a study of creative thought and to develop an interest in it; next to offer some suggestions as to the natural history of mind in its most inspired moments; finally, to institute a regime for the individual whereby he may secure the highest mental efficiency." Part I deals with the natural history of genius, and presents psychological, philosophical, and popular descriptions of the nature of consciousness, discusses Ostwald's view that consciousness is a form of energy, and gives some accounts of the relation between genius and the subconscious. Part II is concerned with the origin of new ideas, presenting various views of inspiration, deriving so-called laws of inspiration, and narrating instances of genius in pathological situations. Part III considers such biological factors as the relationship of age and sex to originality. Part IV enumerates hindrances to originality, as an undue regard for the past, defective home training, false education, lack of a science of reading, low standards of merit, incomplete effort, and professional bias. Part V examines the claims made by some that originality is now impossible, that the great steps in innovation have been taken, and that there is nothing left but minute amplifications of existing attainments. With this view the author has no sympathy, but rather sees indefinite expansion for the future. Finally, Part VI displays an array of reflections on mental attitudes and methods of creative activity. The particular merit of the book lies in the large number of opinions of eminent men brought together and focussed on the question of originality

ALBERT H. LEAKE. *The Vocational Education of Girls and Women.* New York: The Macmillan Company, 1918. Pp. xix, 430. $1.60.

In view of the rate at which women are coming to take the place of men in doing the work of the world it would seem to require no little daring to forecast just what vocational education girls should have. The author fortifies himself against any such attack by disclaiming in the preface any intention to consider the vast number of new occupations which women are now entering, and contents himself with de-

scribing the types of vocational education already offered. This task is admirably performed, and the book will undoubtedly take its place as a standard reference work on the subject. There is first a consideration of the status of instruction in household arts, and a description of typical courses for the elementary school, the high school, credit for work done in the home, forms of continuation schools, and special modifications for prevocational schools, homemaking schools and trade schools. There is a frank and fair discussion of the problem of domestic service and its possible solution in cooperative housekeeping. Part II deals with education for industries outside the home, taking up the conditions of such industries, the problems of factory labor, the organization of trade schools, evening schools, commercial education for salesmanship, and the possibilities of vocational guidance for women. There is an annotated bibliography of fifteen pages.

Maryland Public Schools. Fifty-first Annual Report of the State Board of Education Showing the Condition of the Public Schools of Maryland for the Year Ending July 31, 1917. Pp. 381.

This is an account of the operation of Maryland schools for the first year under the new school law. Features of the report are the workings of the compulsory school law, the methods of rural school supervision, and the status of rural school houses.

FLORENCE MATEER. *Child Behavior. A Critical and Experimental Study of Young Children by the Method of Conditioned Reflexes.* Boston: Richard G. Badger, 1918. Pp. 239. $2.00.

This is an interesting departure in child study. The author first gives a historical account of child study and a critical evaluation of its results. There follows a discussion of behaviorism and its significance for child study, and a rather full account of the experiments of Krasnogorski on the formation and breaking of conditioned reflexes in children. In her own experiments the author used a modified form of the Krasnogorski method, and supplemented this with physical measurements of height, weight, grip, lung capacity, and with tests of mental age by the Binet and the Yerkes scales, form board, and other tests. The author believes that the study of conditioned reflexes promises to yield important data for a real science of child study.

Measurement of Educational Products. The Seventh Yearbook of the National Society for the Study of Education, Part II. Prepared under the supervision of the National Association of the Directors of Educational Research. Bloomington, Illinois: Public School Publishing Company, 1918. Pp. 194. $0.90.

This yearbook constitutes a landmark in the history of educational measurements. It is full of interesting and valuable material that should not be ignored by progressive educators. The papers are "History and Present Status of Educational Measurements" by Leonard P. Ayres; "The Nature, Purposes and General Methods of Measurements of Educational Products" by Edward L. Thorndike; "Specific Uses of Measurement in the Solution of School Problems" by M. E. Haggerty; "General Organization of Measurement Work in City School Systems" by Frank W. Ballou; "Bureaus of Research in City School Systems" by Eugene A. Nifenecker; "Cooperative Work from a University Center" by Ernest J. Ashbaugh; "Existing Tests and Standards" by Walter S. Monroe; "Related Forms of Educational

Investigation" by W. A. Averill; "Statistical Terms and Methods" by B. R. Buckingham; "Training Courses in Educational Measurement" by S. A. Courtis; "Suggestions for Experimental Work" by George Melcher; "A Look Forward" by Charles H. Judd; and "A Selected Bibliography of Certain Phases of Educational Measurement" (606 titles) by Edna Bryner.

MILLICENT OLMSTED. *The Land of Never Was.* New York: Hurst and Company. Pp. 148.

This delightful story for the little folks describes a journey to Moon-Goose land, and recounts the experiences of the three children who took the trip. The essential feature of the visit was a school in which the pupils acted out all of the stories in the Mother Goose rhymes. It is excellent supplementary reading for the second grade.

MAURICE PARMELEE. *Criminology.* New York: The Macmillan Company, 1918. Pp. xiii, 522. $2.00.

In this book the well-known author of "The Science of Human Behavior" has attempted a comprehensive survey of the whole field of criminology. The book is a companion volume to his "Poverty and Social Progress," and the two together furnish a description of what he calls the two greatest social evils, poverty and crime. In tracing the origins of crime the author goes back to the equivalents of crime and punishment among animals, sketches the main types of crime among primitive peoples, and finds the key to its evolution in the conflict between the interests of the individual and organized society. Among the environmental factors involved in crime are climate and the weather, urban and rural populations, economic conditions, and political organization. On the subjective side we note the anatomical and physiological studies of criminals, the mental traits of the criminal diathesis, criminal amentia, various classifications of criminals into types, juvenile criminality and female criminality. Under criminal jurisprudence the author traces the development of criminal law, compares different types of criminal procedure, outlines the recent growth of recognized principles of evidence, advocates public defense as well as public prosecution, and indicates the functions of the judge, the jury and the police. Of particular interest for the psychologist is the discussion of the origin and evolution of punishment, the connection between moral ideas and punishment, the individualization of punishment, the arguments for and against capital punishment, and the evils of our prison system. Finally the author considers political and evolutive crime, freedom of speech, regulative social legislation, and the prevention of crime. Due account is taken of recent investigations in the psychology of crime, and there is a strong plea for a more general recognition of the psychological point of view.

AGNES LOW ROGERS. *Experimental Tests of Mathematical Ability and Their Prognostic Value.* Teachers College Contributions to Education No. 89. New York: Teachers College, Columbia University, 1918. Pp. 118.

This is an extremely important study of abilities in high school mathematics. There is a good summary of previous work on mathematical abilities, a description of the thirteen algebraic, geometrical and arithmetical tests used, and an account of the supplementary tests in language ability. The latter were the mixed relations, the logical opposites, the Trabue language scales, and the Thorndike reading scales.

The tests were given to fifty-three pupils of Wadleigh High School, New York City, and sixty-one pupils in the Horace Mann High School for Girls. The author presents elaborate tables of reliability coefficients and coefficients of correlation. It is interesting to note that correlation between verbal ability and mathematical ability is higher (.65) than that between any other pair of results. Whether this means that mathematical ability depends upon verbal ability or not, it indicates that the two abilities are found largely together. The diagnostic and prognostic values of certain tests were high, so that an hour and a half spent with these tests may be expected to give a correlation of .60 to .80 with future mathematical achievement.

HAROLD ORDWAY RUGG AND JOHN ROSCOE CLARK. *Scientific Method in the Reconstruction of Ninth-Grade Mathematics.* Supplementary Educational Monographs, Vol. II, No. 1, April, 1918. Chicago: University of Chicago Press, Pp. v, 189. $1.00.

This is one of the most important constructive monographs on the teaching of mathematics that has ever been written. In the introductory chapter the authors show the prevailing discontent with ninth-grade mathematics, and assert that it cannot be rearranged or reorganized but must be rebuilt from the ground up. There follow a minute analysis of what is done in ninth-grade mathematics, a historical study of how algebra became the ninth-grade course, an account of the construction of standard tests in algebra, a brief report on the application of these tests to many thousand pupils, an analysis of the errors revealed by these tests and the necessary corrective procedure, a study of the training in "logical thinking" afforded by mathematics, a survey of curricula in secondary mathematics, and an account of experimental teaching in ninth grade mathematics. The authors urge discussion, constructive criticism, experimentation, observation of others' work, the keeping of records, and co-operation amongst teachers.

MAJOR E. Z. STEEVER, III. AND MAJOR J. L. FRINK. *The Cadet Manual. Official Handbook for High School Volunteers of the United States.* Philadelphia: J. B. Lippincott Company, 1918. Pp. xxxi, 315. $1.50.

The High School Volunteers of the United States is the high school military organization officially recognized by the War Department, and it is now rapidly spreading over the entire country. The different parts of the Manual are devoted to the regulations, drill (taken from the infantry drill regulations of the United States Army), the use of the rifle, signals and signaling, different types of setting-up exercises, and wall scaling, cadet shows and competitions. An appendix gives the War Department requirements for installing the H. S. V. U. S. system in the high school.

C. W. SUTTON. *The Arithmetical Abilities of School Children as Shown by Courtis Tests.* Cleveland, Ohio: Division of Reference and Research, Bulletin No. 1, 1917. Pp. 15.

The results of the application of the Courtis Tests, Series B, to grades four to eight in thirty-six schools. Cleveland stands well in grades four, five and six, but falls off in grades seven and eight. Special drill is recommended for those children below standard. The danger here is in directing the attention of the teacher exclusively to the dullards and ignoring the more educable pupils. It perpetuates the vicious mass fallacy which educational measurements should help us destroy.

Third Report of the Committee on Economy of Time in Education. The Seventh Yearbook of the National Society for the Study of Education, Part I. Bloomington, Illinois; Public School Publishing Company, 1918. Pp. 134. $0.75.

The greater part of this year book is devoted to the place of history and civics in the elementary school. Other papers deal with social demands on the course of study in arithmetic, minimal essentials of elementary school geography, vocabularies of second year readers, and composition standards for the elementary grades. A history symposium emphasizes a broader outlook on world happenings and more attention to social and industrial conditions.

W. W. THEISEN. *An Educational Survey of Janesville, Wisconsin.* Madison, Wisconsin: State Department of Public Instruction, 1918. Pp. 329.

Of especial interest is Chapter XIII, *Measuring Results in School Subjects.* In arithmetic the Woody tests, the Courtis tests, Series B, and the Stone Reasoning tests were used. The Kansas Silent Reading Tests and the Ayres and Buckingham spelling lists were given, the hand writing measured by the Thorndike, Ayres and Freeman scales, compositions were evaluated on the basis of the Hillegas scale, and the Trabue Language Tests were given. Not the least important aspects of the survey are the valuable comments on methods of measurement.

ARTHUR JAMES TODD. *Theories of Social Progress. A Critical Study of the Attempts to Formulate the Conditions of Human Advance.* New York: The Macmillan Company, 1918. Pp. xii, 579. $2.25.

Is society progressing? In view of the aspect of the present orgy of destruction many will be inclined to deny it. Everything depends on what we mean by progress. The author contends that it should be possible to work out a series of objective tests for social progress; and if we are ever to have a Science of Society such objective tests must be part of its ultimate purpose. Thus the author stands committed to the same quest for objective measurements of social progress that some of us are engaged in for education. More than this,—he clearly recognizes how important for society as a whole is the striving for better and more efficient standards of education. "If humanity is to hold the threads of its own destiny and rise from ages of blind drift to a plane of mastery, it will be through discovering and utilizing new types of education." Frankly admitting that as yet we have no objective scale of social measurements, he thinks that the best method of attacking the problem is by surveying and organizing the theories of social progress that have been proposed. This he does in a very able and attractive fashion. documenting his argument with copious citations to the original sources. It is a sane, scholarly, and enlightening book, and deserves to be widely read by thoughtful educators.

WILLISTON WALKER. *A History of the Christian Church.* New York: Charles Scribner's Sons, 1918. Pp. xiii, 624. $3.00.

The broad-minded educator needs to be familiar with the history of human institutions of all sorts. No single institution has had such a profound educational influence, or embodies to so great an extent the highest ideals and aspirations of humanity as the Christian church. Perhaps we may not subscribe to many of the doctrines promulgated by the church in its various branches, indeed the present volume affords ample reason for the scientifically minded man to hestitate and ponder over religious dogmas of any sort, but every educated man should know the main

outlines of church history in order to appreciate the religious institutions of the present day and to judge of the modifications needed to meet the demands of the future. For this purpose the present book is admirable. The style is clear and graceful, as free as possible from technicalities, the author's scholarship is broad and well-grounded, and his presentation is frank, open, and free from bias. The book reads like a romance, and gives a thrilling picture of the development of western civilization. The value of the work is enhanced by many double-page maps.

A. N. WHITEHEAD. *The Organization of Thought, Educational and Scientific.* Philadelphia: J. B. Lippincott Company, 1917. Pp. vii, 228.

These papers by one of the most eminent English mathematicians and scientists command the attention of all thoughtful students of education. Most of them are addresses delivered since the outbreak of the war, and as such reflect the sentiment of advanced English scientific thinking on the type of education demanded by the new conditions. While the author does not abate one tittle of his enthusiasm for and high valuation of mathematics, he recognizes frankly that mathematical training is for the few. And even for these few he urges a tremendous simplification and condensation on the vital aspects of the subject. Pupils are now overloaded with such a multiplicity of details that mathematics becomes isolated, detached, with little significance for the big things of life.

ROBERT SESSIONS WOODWORTH. *Dynamic Psychology.* New York: Columbia University Press, 1918. Pp. 210. $1.50.

This vigorous and forceful discussion of some of the fundamental problems of psychology will be of interest alike to the pure and to the applied psychologists. The author presents a historical sketch of the modern movement in psychology, distinguishes certain problems such as the difference between "drive" and "mechanism," examines the drives and mechanisms that are native to the human organism and those that are acquired, discusses the factors of selection and control in reactions and the factors of originality, and considers some outstanding drives and mechanisms involved in abnormal behavior and in the reactions of animals. By mechanism the author means the psycho-neuro-muscular adjustment on which a reaction depends, and gives an answer to the question how does the reaction take place. Drive, on the other hand, is the motive, the urge, the reason why the organism reacts as it does. Whether drive is not ultimately explainable in terms of mechanism is a question which the author is inclined to answer in the affirmative, but he believes that at this stage of our knowledge the distinction has a pragmatic value.